AGRICULTURAL CHEMICALS

In this issue:

February 1961

"I'm a bag that gets knocked around a lot in my business."

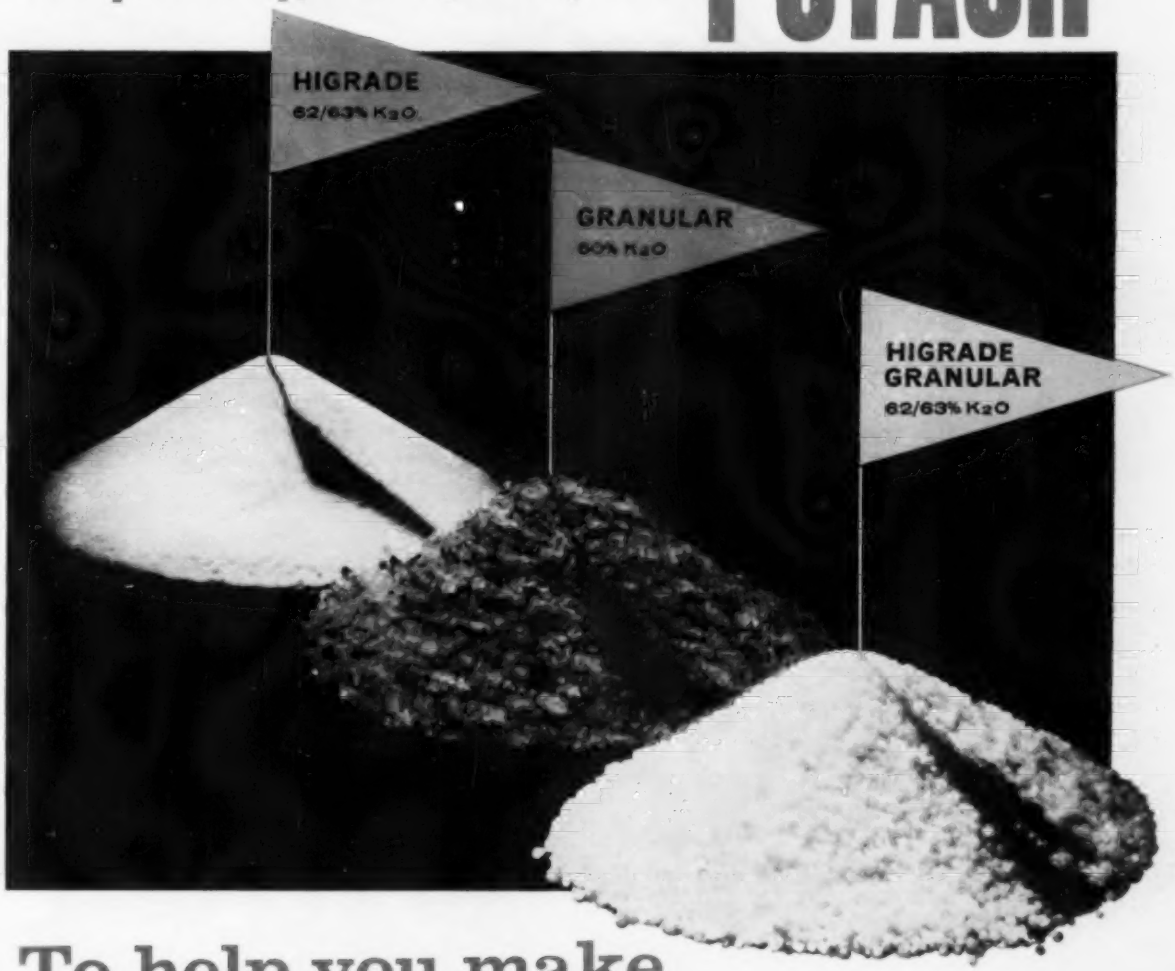
"Me, too. And I don't think I could stand it if Chase didn't know how to pick the paper!" Fact! Chase buys all these types of paper on the open market: stretchable, non-skid, creped or regular kraft...fully bleached, semi-bleached and colored outer sheets. This means Chase has the pick of the best from *many* sources. Result: Bags with maximum strength, minimum bulk, more value for you. You pay no more for the *best* bags, beautifully printed. Make sure you get them—from Chase!

CHASE BAG COMPANY

355 Lexington Avenue—New York 17, N. Y.
32 Plants and Sales Offices Coast to Coast

MULTIWALLS • TEXTILE • PLASTIC AND LAMINATED BAGS • CONSUMER-SIZE PAPER BAGS AND OTHER PACKAGING MATERIALS

For you--3 types of specially sized POTASH



To help you make the best fertilizers...

Now Available!

FERTILIZER BORATE-65

...A NEW SOURCE OF BORON TO SAVE YOU MONEY!

Here's boron at lowest cost per unit! This highly concentrated source of B_2O_3 has a 178% borax equivalent. It can save dollars for you on costs of handling... storage... and transportation. It can also improve the physical condition of your mixed fertilizers.

Order Fertilizer Borate-65 now!

Here is potash you can depend upon—for highest quality—for maximum freedom from caking in storage and handling. Take your choice of three types; all readily available for immediate shipment. You'll find each to be ideally sized to meet your current manufacturing requirements.

For more than a quarter of a century, our potash products have kept pace with all the exacting specifications of the fertilizer industry. That's why you can confidently count on getting exactly the kind of potash you want... when you want it... from U. S. Borax & Chemical Corp.

Expert technical assistance is yours for the asking—without any obligation. Write today for technical data and shipping information.

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ATLANTA • CHICAGO • LOS ANGELES

U.S.BORAX

41 plants...for prompt delivery of AA quality products

41 plants of The A.A.C. Co., located in the United States, Cuba and Canada, assure you dependable, fast deliveries of AA quality products for farm and industry. You can schedule your production with confidence . . . the right quantity and grade will be at your plant when you need it.

for uniform quality, prompt delivery and technical service . . . order from

The **American Agricultural Chemical** Company

producers of:

Florida Pebble Phosphate Rock • Superphosphate
AA® QUALITY Ground Phosphate Rock
All grades of Complete Fertilizers • Keystone® Gelatin
Bone Products • Fluosilicates • Ammonium Carbonate
Sulphuric Acid • Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus

GENERAL OFFICE: 100 Church Street, New York 7, N.Y.

This Month's Cover

At this time of year, when both farmers and the agricultural chemical industry are looking ahead to the 1961 crop season with anticipation of profit and such fine yields as are shown in upper left and lower right photos, it should be remembered that much effort, such as spring plowing (upper right) and a lot of fertilizer (lower left) will be required from all concerned.

AG CHEM

Vol. 16, No. 2 February, 1961

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SYMBOLS OF PLANT LIFE

*

Because of the complete ignorance of the masses during the Dark Ages, alchemists, with their knowledge of chemistry, were presumed to be in league with the devil. In experimenting with potash, they were forced to resort to signs and symbols. If they didn't . . . the result could be death!

Distillation During 16th Century

Today, potash means life . . . life to promote food and fiber growth for an ever-growing population.

Southwest Potash Corporation provides a dependable supply of HIGH-K muriate for the plant food industry.

SOUTHWEST POTASH CORPORATION

1270 Avenue of the Americas, New York 20, N.Y.

HIGH-K

**A commonly used 15th Century Symbol for Potash*

MEETING CALENDAR

Feb. 6-8—Association of Southern Agricultural Workers, Agronomy Section, Mississippi State University, State College, Miss.

Feb. 8-10 — Fertilizer and Lime Conference, co-sponsored by Pennsylvania State University and the Pennsylvania Plant Food Educational Society, Nittany Lion Inn, Pennsylvania State University, State College, Pa.

Feb. 9-10 — Executive Committee Meeting, Fertilizer Section, National Safety Council, Colonial Inn, St. Petersburg, Fla.

Feb. 14-15 — Aquatic Weed Control Society, 2nd Annual Meeting, LaSalle Hotel, Chicago.

Feb. 14-16—8th annual Agricultural Chemicals Conference, Texas Technological College, Lubbock, Texas.

Feb. 15 — Pesticides Review for Coastal Counties, San Luis Obispo, Calif.

Feb. 15-17 — Midwestern Chapter, National Shade Tree Conference, 16th annual meeting, LaSalle Hotel, Chicago.

Feb. 16-17 — Annual Conference of Midwestern Agronomists and Fertilizer Industry Representatives, Edgewater Beach Hotel, Chicago, Ill.

Feb. 21-22 — Pest Control Conference, sponsored by the Agricultural Experiment Station and the Extension Service, Auburn University, Auburn, Ala., Thomas Jefferson Hotel, Birmingham, Ala.

Feb. 28 - Mar. 1 — Tenth Annual Pesticide Chemicals School, sponsored by the departments of Entomology & Zoology and Botany & Bacteriology, Clemson College, Clemson, S. C.

Mar. 3 — Mid-West Agricultural Chemical Association, Omaha, Nebraska.

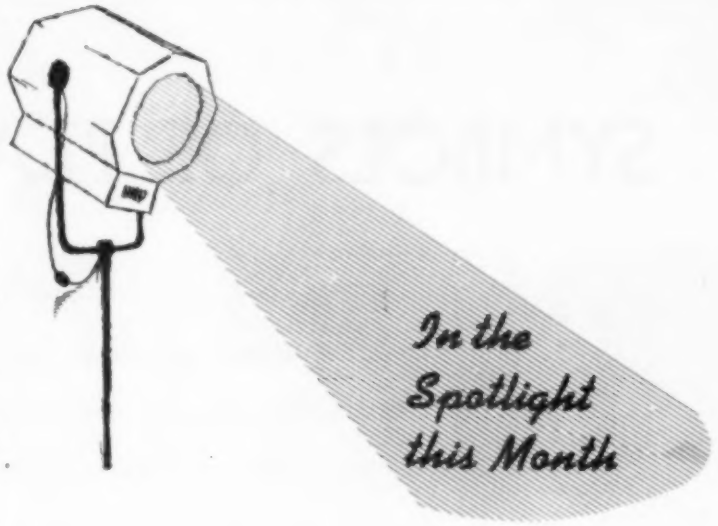
Mar. 13-15—Spring Meeting, Western Agricultural Chemicals Association, Disneyland Hotel, Anaheim, Calif.

Mar. 21-30 — 139th National Meeting, American Chemical Society, St. Louis, Mo.

June 9-17 — European Congress of Chemical Engineers and ACHEMA Congress 1961, Frankfurt am Main, Germany.

June 11-14 — Annual convention, National Plant Food Institute, The Greenbrier, White Sulphur Springs, W. Va.

Sep. 3-8 — 140th National Meeting, American Chemical Society, and National Chemical Exposition, Chicago.



- **Crop Response** . . . The effects of granulation on crop response to each component of fertilizer are considered separately by a TVA authority. Well-granulated fertilizers have advantages in physical condition over non-granular materials, but agronomic advantages often are not so obvious. Page 30.

- **Northeastern Weed Conference** . . . The development of promising new compounds for weed control and many new uses for some of the older compounds are discussed at 15th meeting of the Northeastern Weed Control Conference. Almost 700 persons attend. Page 32.

- **Nematode Research** . . . A report heard at a meeting of the Soil & Crop Science Society of Florida indicates that there remains a great deal to be discovered about nematodes. Among areas where further information is needed are; parasitism, pathogenicity, life cycles, and the degree of plant injury that may be caused by any particular nematode population. Page 41.

- **European Fertilizer Technology** . . . A first-hand report of a visit to twenty European fertilizer companies by a U. S. fertilizer authority and a discussion of the practices that keep European fertilizer prices competitive despite high raw materials costs. Page 38.

- **State Pesticide Committees** . . . Committees in California and Wisconsin have presented reports concerning the relation of pesticide use to the health of the public and wildlife. Some conflicting views are expressed. Page 49.

- **Chemicals On Cotton** . . . A discussion of the current and prospective situation affecting the use of agricultural chemicals on cotton is taken from a talk delivered last month at the Beltwide Cotton Production-Mechanization Conference. Page 37.

WHAT ARE DRI-SOL® BENEFITS IN MIXED-FERTILIZER PRODUCTION?

REDUCED SHIPPING COSTS

BETTER PROCESS CONTROL

LOWER FORMULATION COSTS

LOWER DRYING COSTS

A DRIER PRODUCT

INCREASED PLANT CAPACITY

FASTER CURING—QUICKER SHIPMENT

IMPROVED FERTILIZER QUALITY

More and more fertilizer manufacturers are turning to DRI-SOL ammoniating solutions as a sure, time-tested way to lower production costs and improve mixed-fertilizer quality.

For in addition to the eight cost-saving and quality-building advantages shown above, DRI-SOL can also help manufacturers offset the high water content of low-strength acid. It also helps to produce grades which are difficult or impossible to make with conventional solutions.

What grade of DRI-SOL meets your needs best? From a wide choice of formulations you can select the solution that offers you the greatest number of advantages. Each grade contains less than 0.5% water. Grades range from 24% ammonia and 76% ammonium nitrate, to 50% ammonia and 50% ammonium nitrate, and are generally available in all the Southern and Midwestern States.

Why not get complete information? Technical data to fertilizer manufacturers available upon request. Write: Agricultural Chemicals Department, Commercial Solvents Corporation, 260 Madison Avenue, New York 16, New York. Offices also located in: Atlanta, Shreveport, St. Louis.

COMMERCIAL SOLVENTS CORPORATION CSC

WHAT ARE YOUR FERTILIZER PLANT DESIGN REQUIREMENTS?

Dorr-Oliver has had 45 years' experience in the field of concentrated fertilizer production via the wet process of manufacturing phosphoric acid. Dorr-Oliver designs and builds complete plants.

Let us send an engineer to discuss your requirements.

PHOSPHORIC ACID

Dorr-Oliver designs plants for producing strong acid (32 to 33% P_2O_5) directly by its well-known process.

DIAMMONIUM PHOSPHATE BASED COMPOUNDS

Dorr-Oliver designs plants producing directly from 32 to 40% P_2O_5 phosphoric acid a wide variety of compounds such as 14-14-14, 14-28-14, 12-36-12, 11-48-0, 16-20-0 and 18-46-0 as hard, uniform, free-flowing granules based on mono or diammonium phosphates.

PHOSPHORIC ACID EVAPORATION

Dorr-Oliver designed vacuum evaporator stations eliminate serious scaling, reduce P_2O_5 losses to a negligible point and involve no fume problem.

NON-GRANULAR TRIPLE SUPERPHOSPHATE

Dorr-Oliver designs plants for producing a soft triple superphosphate with optimum characteristics for mixing and ammoniation.

AMMONIUM SULFATE FROM CALCIUM SULPHATE

Dorr-Oliver has successful experience in the use of by-product gypsum from phosphoric acid

MIXING AND GRANULATION

Dorr-Oliver designs plants for producing compounds in the form of hard, uniform, free-flowing granules from a variety of raw materials in solid or liquid form.

TRIPLE SUPERPHOSPHATE FOR DIRECT APPLICATION

Dorr-Oliver designs plants to produce hard, uniform, free-flowing granules by its own process requiring evaporation to only 38% P_2O_5 with no need for subsequent curing.

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WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

5 out of 5 pests agree!

The best sorptive carriers for pesticides are Floridin Fuller's Earth products. Their high sorptive capacity, ideal bulk density, good flowability and excellent wettability assure profitable formulations. • Diluex® and Diluex A are fine mesh products used for concentrate formulations—either dustbase or wettable powders. They are also used extensively to condition finished formulations. • Florex® RVM and Florex LVM are sorptive granular carriers used as base materials for granular pesticide formulations for soil application. • To obtain more information on these quality carriers and extenders, and for details on their use with the pesticides you formulate, just complete and send us the coupon below.

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Gentlemen: Please send me your free catalog on Diluex and Florex carriers and diluents.

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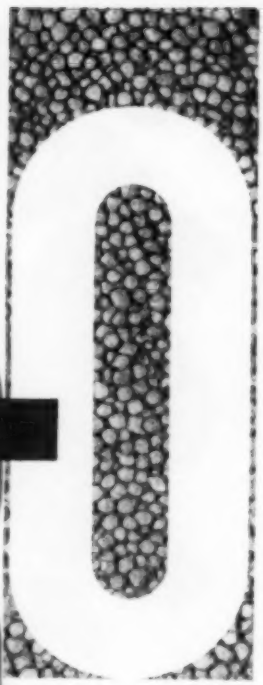
Newest member of the Davison team of granulated phosphates...



16-48-0

DAVISON Diammonium Phosphate

MAKES HIGHER ANALYSIS MIXTURES . . . than before—and makes them more easily. 16 units of highly soluble NITROGEN—Plus 48 guaranteed units of AVAILABLE P_2O_5.

FOR DIRECT APPLICATION . . . an exact 1-3-0 ratio—ready to use and sell . . . beautifully granulated.

FOR DRY MIXING . . . Davison Diammonium affords the dry blend manufacturer the advantages of an ammoniation plant. A balanced 1-3-0 ratio simplifies formula calculations.

READY FOR SHIPMENT . . . right now. Make this profitable new phosphate part of your operation. Call Davison in Baltimore today at SAratoga 7-3900.

GRACE

DAVISON CHEMICAL Agricultural Chemicals Division, Baltimore 3, Md.

Some formulations of ratios in higher analysis grades using DAVISON 16-48-0

Ratio Analysis	Pounds of Material Required			
	16-48-0	Ammo. Sul. (21%N)	Triple (46%APA)	Potash (60% K_2O)
1-1-1 14.4-14.4-14.4	602	917		481
1-2-2 11-22-22	917	349		734
1-4-2 8.5-34-17	1063		370	567
1-4-4 6.6-26.5-26.5	828		290	882

**Other higher analysis nitrogen materials (urea and ammonium nitrate) may be substituted in above formulations.* Analysis in the more popular ratios, such as 12-12-12, 10-20-20, 6-24-12, 5-20-20, can be manufactured by the addition of granular dolomitic limestone or other materials.

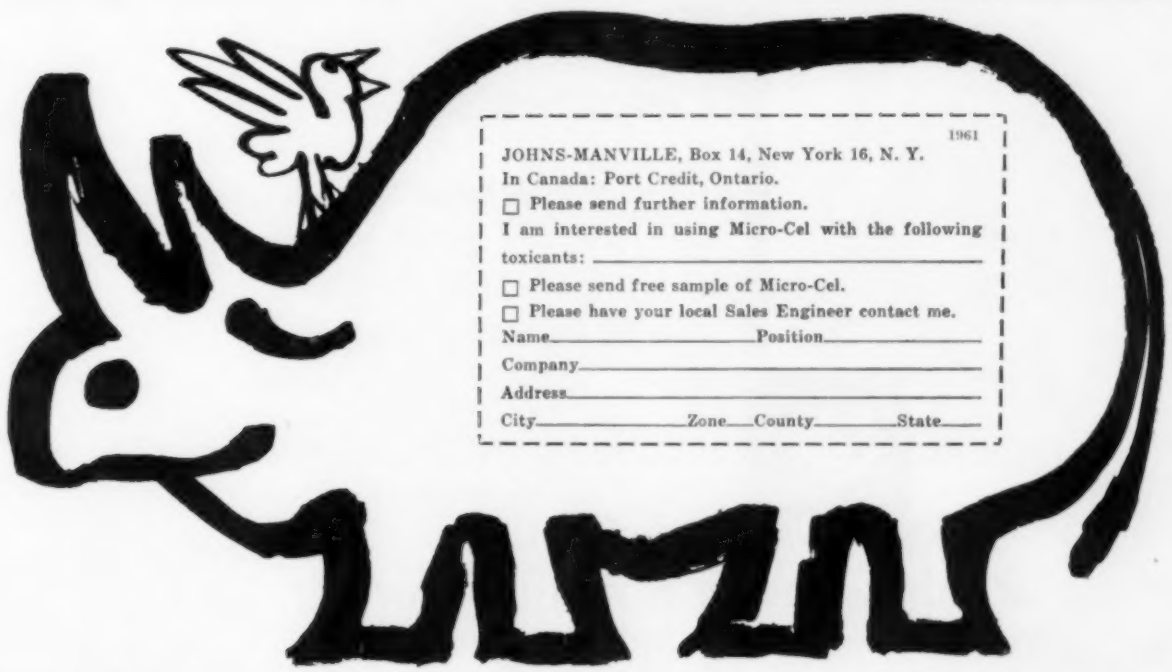
Electron micrographs showing plate-like Micro-Cel E and spherical Micro-Cel B structures.

1μ

Micro-Cel is quite compatible!

Micro-Cel®, Johns-Manville's new synthetic calcium silicate, is chemically inert and is compatible with nearly all toxicants. Micro-Cel cuts shipping costs by permitting such high toxicant concentrations as 50% Heptachlor, 70% Toxaphene and 75% DDT. Micro-Cel's unique structural characteristics (surface areas up to 175 sq. m/gr) reduce caking, improve flowability, increase suspendability and extend shelf life. For further information, samples and technical assistance, mail in the coupon below!

JOHNS-MANVILLE
Celite Division



1961

JOHNS-MANVILLE, Box 14, New York 16, N. Y.
In Canada: Port Credit, Ontario.

☐ Please send further information.

I am interested in using Micro-Cel with the following toxicants: _____

☐ Please send free sample of Micro-Cel.

☐ Please have your local Sales Engineer contact me.

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ County_____ State____

FROM JOHN DEERE COME QUALITY UREA NITROGEN PRODUCTS

JOHN DEERE 45

. . . 45% nitrogen . . . a specially conditioned source of nitrogen for use in direct application. Prilled, non-caking, and even flowing for smooth distribution . . . concentrated to save time, labor and storage space.

UNCOATED UREA

. . . 46% fertilizer grade nitrogen . . . preferred for a concentrated nitrogen source in liquids and mixes.

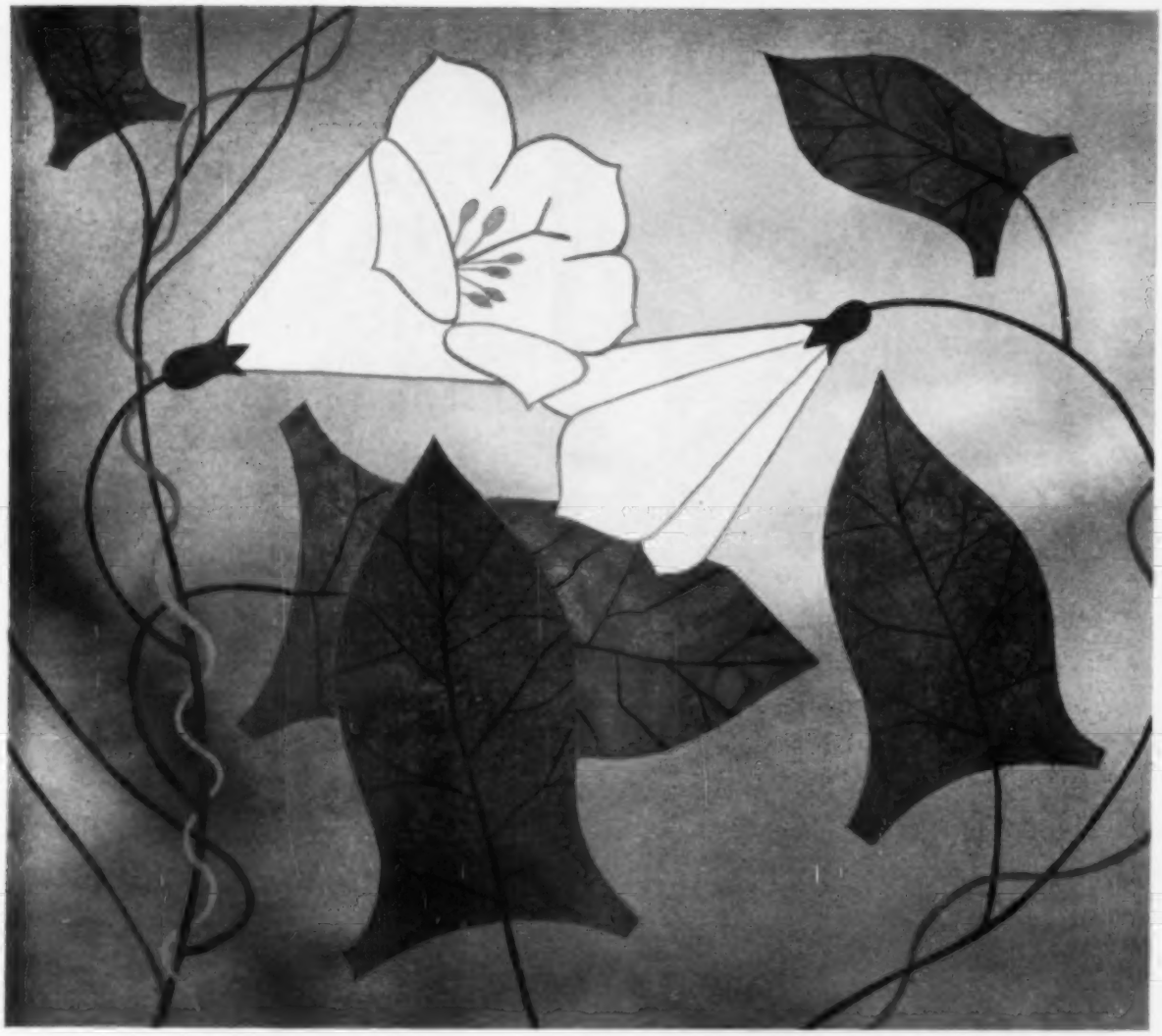
UREA-AMMONIA SOLUTIONS

. . . economical, practical for mixed fertilizers. Non-corrosive to protect valuable equipment . . . leach resistant . . . easy mixing . . . ideal for batch or continuous mixing.

For service that's
FAST . . . PERSONAL . . . DEPENDABLE

JOHN DEERE

JOHN DEERE CHEMICAL COMPANY
PRYOR, OKLAHOMA



CONTROL BINDWEED

WITH OLDBURY® SODIUM CHLORATE

Oldbury sodium chlorate was the most effective weed killer when it was first placed on the herbicide market thirty-five years ago . . . and it's still the most effective you can use today on such troublemakers as bindweed, Johnson grass, Canada thistle, and Russian knapweed.

Oldbury sodium chlorate *sterilizes* the soil . . . reaches right down to the roots of the weed . . . and keeps working for months.

Oldbury sodium chlorate is inexpensive. For a mere 25¢, you can sterilize 100 square feet of drainage ditch, fence line, or roadway.

Open-head drum empties easily. Oldbury sodium chlorate comes in a fast-opening drum. A single lever seals and reseals the drum with a metal band. Full-open head makes pouring, scooping, or shoveling easy.

Available in 50-, 100-, and 450-lb. sizes.

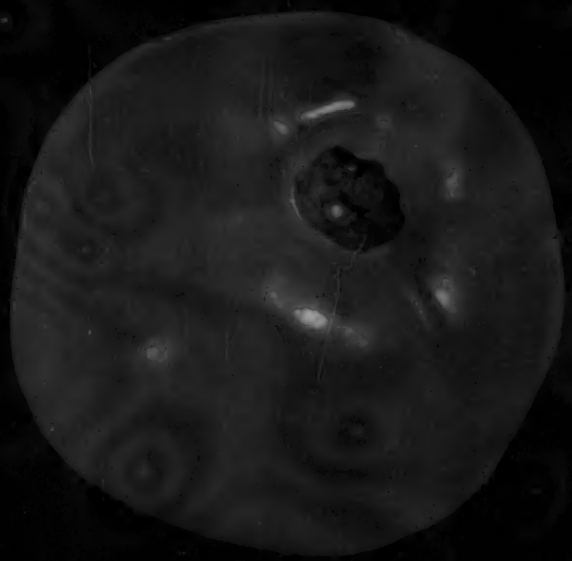
Technical aid. Full-time Hooker agronomists can help with weed control plans and advise on handling, storing, and using sodium chlorate. Write for descriptive folder.

HOOKER CHEMICAL CORPORATION

602 BUFFALO AVENUE, NIAGARA FALLS, NEW YORK

HOOKER CHEMICALS PLASTICS

Sales offices: Buffalo, Chicago, Detroit, Los Angeles, New York, Niagara Falls, Philadelphia, Tacoma, Worcester, Mass. *In Canada:* Hooker Chemicals Limited, North Vancouver, B.C.



You can save some real money when you specify the Calumet C-Line Brown Copper Oxide over water-soluble copper sulfate in your fertilizer. Without sacrifice to quality, cost-conscious growers and manufacturers have reduced their copper cost significantly over the past years.

USE THE CALUMET C LINE TO CORRECT SOIL DEFICIENCIES

High copper concentration in the two types of Calumet Brown Copper Oxide reduces material requirements, too. Grade 50 requires only about one-half and grade 75 one-third to give an equal metallic concentration, saving on freight, warehousing and handling.

Compared with highly soluble copper salt, Brown Copper Oxide stays available month after month, dissolving slowly and not leaching out quickly. Most important, you get high yields of better quality fruits and vegetables.

Be Sure to Write, Wire or Phone for More Details

THE C LINE IS THE CALUMET LINE

CALUMET DIVISION

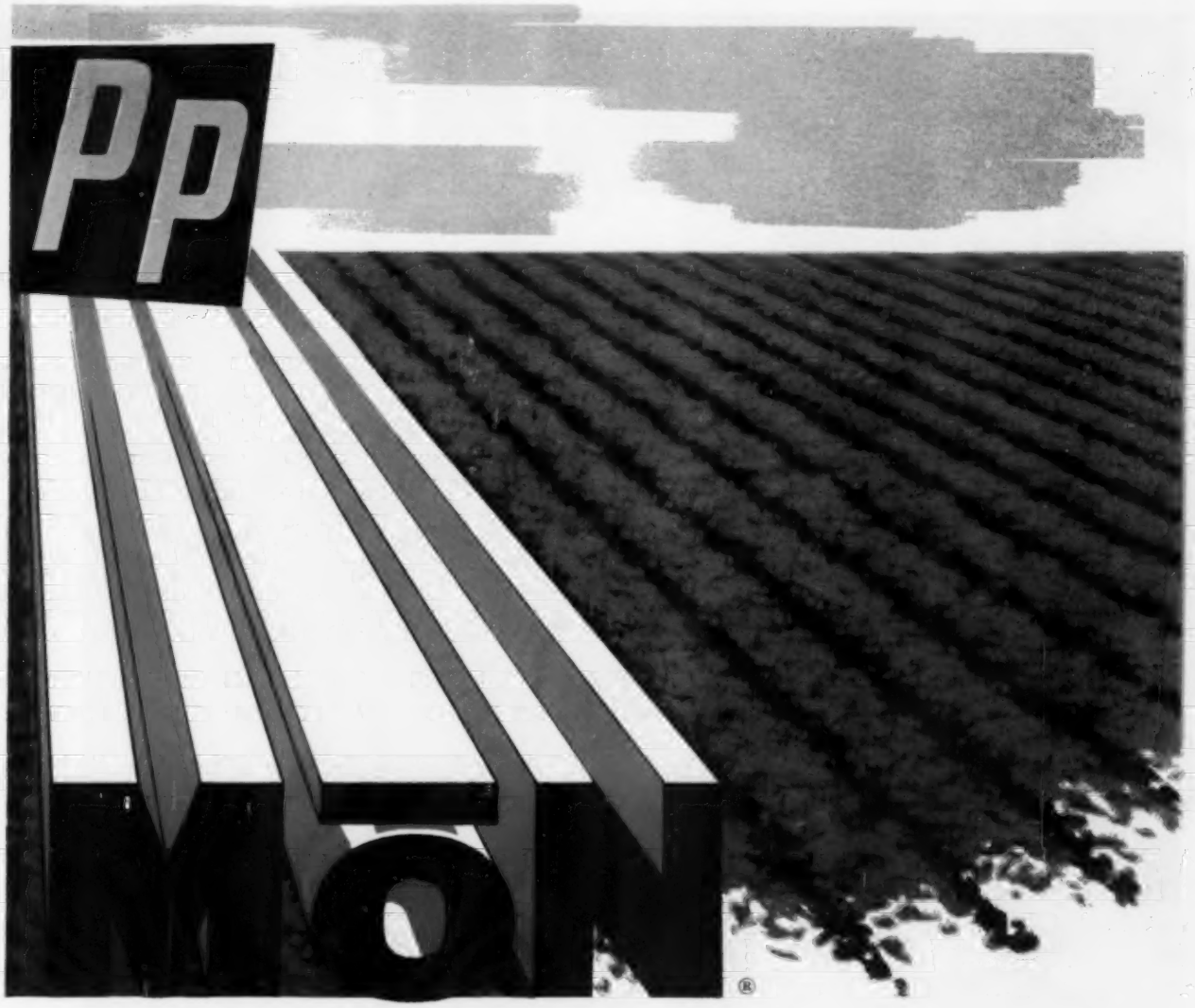
Calumet & Hecla, Inc.

25 CALUMET AVENUE • CALUMET, MICHIGAN

18-46-0

For production of high and ultra-high analysis fertilizers which cannot be produced with conventional materials.

The Country's Largest and most Dependable Source of Phosphate Products for High Analysis Formulations!



GRANULATED

For further information and your requirements–Contact Our

Sales Agents **BRADLEY & BAKER**

U.S. PHOSPHORIC PRODUCTS

TAMPA, FLORIDA

Division

TENNESSEE CORPORATION

One bag shattered . . . the other has two-way stretch

The *unbroken* bag is made of H&W's new high-strength Expanda-Kraft.

As the lift truck braked to a sudden stop, both bags flew through the air and fell hard against the concrete floor. The regular kraft bag split open — note the spilled flour. Yet, look closely at Expanda-Kraft. *Not a sign of breakage*! Naturally, both bags were identical in basis weight and number of plies.

Expanda-Kraft is stronger, because it's made by a special roll-crepe process. It's resilient, has two-way stretch that soaks up shock. Available in white, semi-bleached and natural.

Expanda-Kraft comes in 40, 50, 60, 70, 80 and 100-pound basis weights. *For samples and information*, write Hollingsworth & Whitney, Division of Scott Paper Company, Chester, Pennsylvania.

EXPANDA-KRAFT®

HOLLINGSWORTH & WHITNEY DIVISION OF
SCOTT PAPER COMPANY
AGRICULTURAL CHEMICALS

This familiar symbol represents the expanding facilities behind . . .

SWIFT'S MINUTE MAN PHOSPHATES

Phosphate Rock—Ground and Unground Triple Superphosphate

Ample, modern facilities are essential to provide the high standards of service which are the rule at Swift's Phosphate Center.

Good intentions and the desire to provide service mean nothing to you unless they are backed up by facilities which are adequate to fill all your requirements on time. That's why Swift's Phosphate Center will soon be expanded. New facilities will be added to assure the capacity necessary to serve you best. As the Minute Man symbol suggests, Swift's Phosphate Center is not only ready and willing to serve you, but fully capable of serving you as well.

You'll enjoy doing business with Swift's Phosphate Center . . . with dedicated people who want to serve you and are backed by the facilities necessary to serve you. Have a Swift Phosphate Center Representative outline the advantages Swift's service offers you in phosphates—triple, phosphate rock or ground phosphate rock.

THE SERVICE CENTER FOR ALL YOUR PHOSPHATE NEEDS

SWIFT & COMPANY
Phosphate Center • Bartow, Florida

Swift
PHOSPHATE CENTER

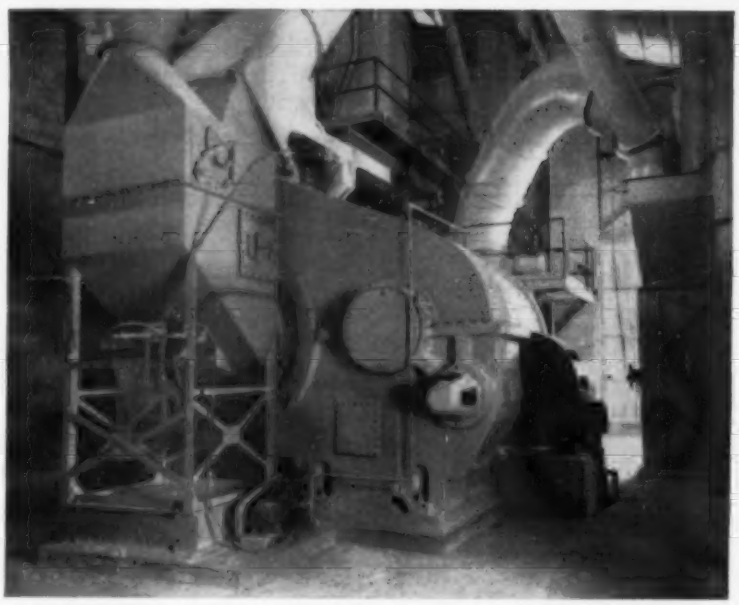
P-7

To Serve Your Industry Better

WITH MINUTE MAN PHOSPHATE ROCK, GROUND PHOSPHATE ROCK AND TRIPLE SUPERPHOSPHATE

LOWER
production costs with a
KENNEDY
air swept grinding system

The KENNEDY Air Swept Tube Mill Grinding System is the ultimate in high production and low operating cost. The experience of the many owners of KENNEDY Mills has shown that the cost of this mill can be paid in a few years with the savings in maintenance and power alone!



KENNEDY 10′ x 15′ Integral Gear Drive Air Swept Ball Tube Mill and #93 Exhauster Fan in service at the American Agricultural Chemical Co., Pierce, Florida.

HERE ARE A FEW OF THE REASONS FOR THE ECONOMY AND POPULARITY OF KENNEDY PULVERIZING SYSTEMS...

REDUCED MAINTENANCE • Tramp iron and other foreign material cannot damage the system. Years of operation are assured before parts (except for grinding balls) require replacement.

CONTINUITY OF OPERATION • Lubrication and replacement of grinding media is accomplished without shutdown or interruption of production.

MINIMUM POWER • Careful design and construction and a proven pressure lubrication system insure a high mechanical efficiency.

HIGHER PRODUCTION • Single grinding units are built for capacities to 100 tons per hour. Production and fineness remain constant, month after month.

LOWER OPERATING COSTS • Dependability of equipment and reliable automatic feed control assure high production with minimum manpower.

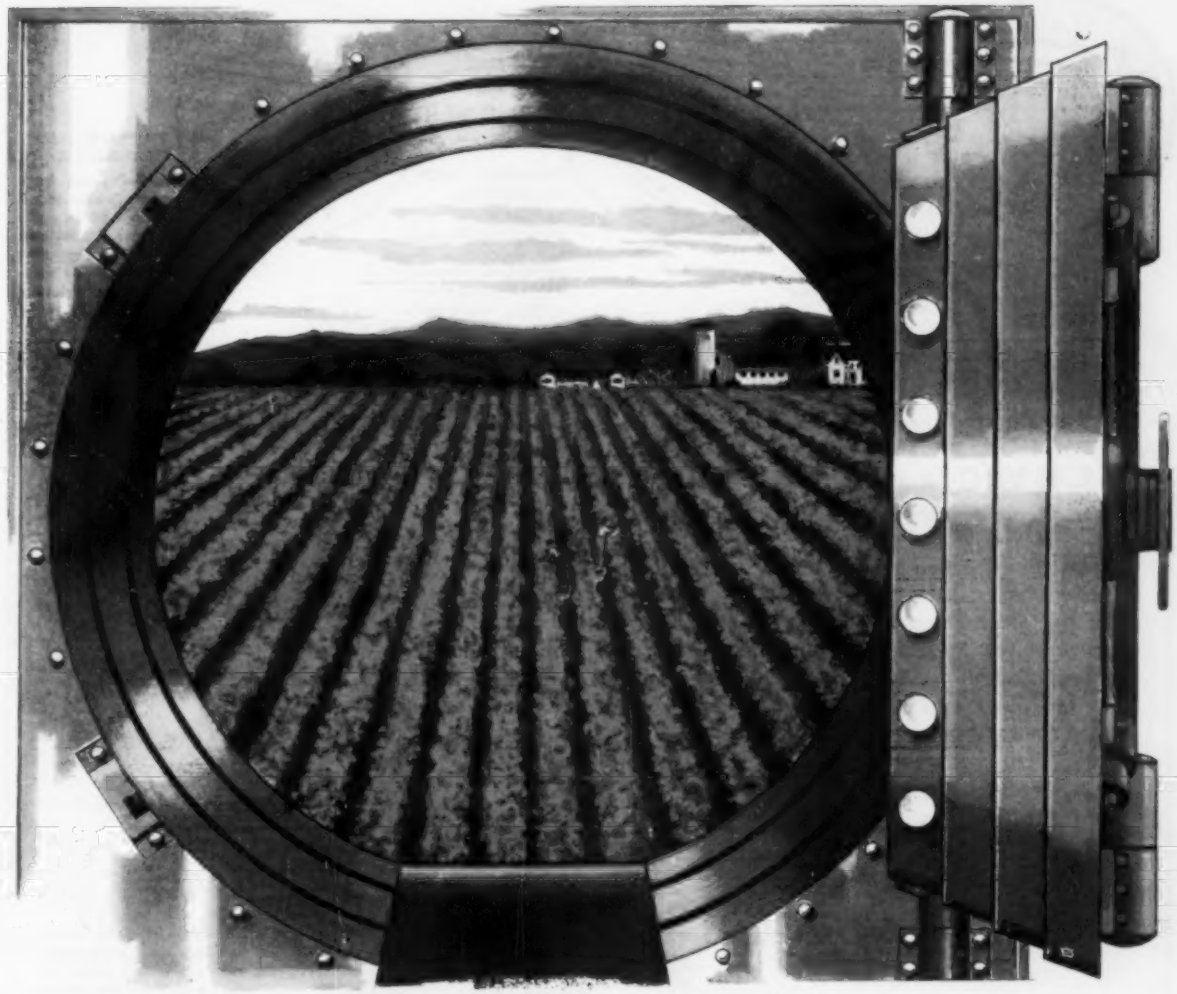
CAPITAL SAVINGS • No magnetic separators are required. KENNEDY units require less structural steel and floor space per ton of product.

FLEXIBILITY OF DESIGN • KVS Air Swept Grinding Systems are available for a wide range of capacities and products.

K V S

Send now for full details on KENNEDY Size Reduction Equipment.

KENNEDY VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.



Bank on bigger profits with
the hottest nematode control in the west!

Nemagon®
SOIL FUMIGANT

It pays to sell Nemagon Soil Fumigant. Growers' enthusiastic acceptance of this effective nematode killer makes Nemagon Soil Fumigant the hottest nematicide in the west. As growers' acceptance soars, so do your sales.

Nemagon Soil Fumigant is available for use in both liquid and granular forms. Liquid Nemagon Soil Fumigant can be applied with simple gravity-flow or pressure-feed equipment...it can even be applied in irrigation water.

In dry applications, Nemagon Soil Fumigant can be included in fertilizer and/or seeding operations . . . growers can plant, fertilize and fumigate in one time- and labor-saving operation.

Important, too, Nemagon Soil Fumigant can be applied around the roots of many living plants.

Technical information on Nemagon Soil Fumigant and its application is available. Write to:

SHELL CHEMICAL COMPANY

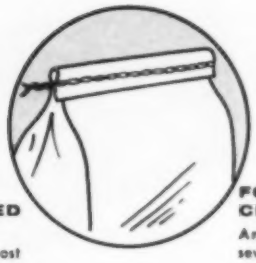
AGRICULTURAL CHEMICALS DIVISION

460 Park Avenue, New York 6, New York

SHELL

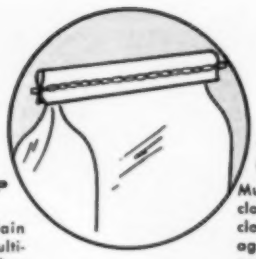
PLAIN SEWED CLOSURE

The simplest and most popular sewed closure for textile, paper-lined textile and paper bags of all sizes.



FOLDED TOP CLOSURE

An excellent plain sewed closure for multiwall paper bags. Bag top is folded over and sewed through to form a strong, neat closure.



TAPE-BOUND CLOSURE

Multiwall paper bags closed with tape-bound closures add to package sales appeal and provide a bag that can be handled without fear of closure breaks.

Offering

LOWER PACKING COSTS! BETTER BAG CLOSURES!

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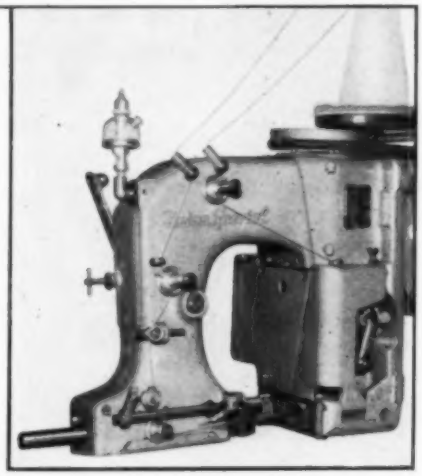

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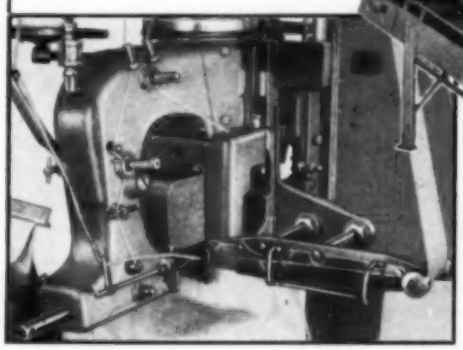

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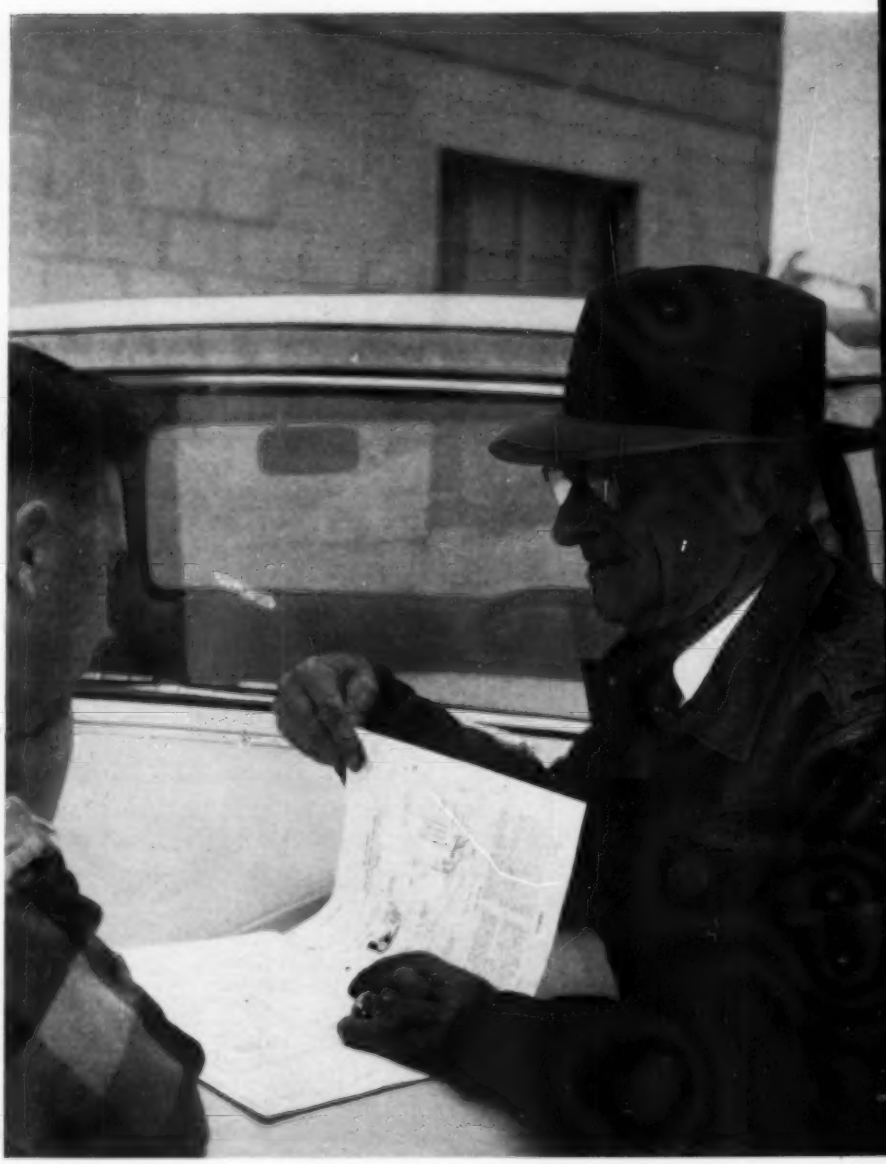

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EDITORIALS

INEFFECTIVENESS of pest control with modern insecticides, and the occasional cases of crop damage which are reported, are due almost entirely to misapplication, in the opinion of most pesticide experts. Today's efficient pesticides are designed to do a job, and are capable of doing it, — but occasionally fail because of ignorance on the part of those who apply the products.

In a recent issue of Agricultural Chemicals the experience of a California rancher was reported, in which the entomologist in charge of operations confirmed that the major problem they face is misapplication of pesticides by custom applicators. "Most of the crop damage and failure to control pests," he reported, "could be traced directly to incorrect chemical application."

This came as no particular surprise to us, for we have been belaboring the same theme, perhaps even too vigorously, over the years. But, we have the feeling that if we keep hammering away on the point we may eventually persuade some of the basic pesticide producers to do something about it. It is a task they can scarcely expect formulators and dealers to assume for them.

On this same theme of insufficient attention to education, we learned with regret recently that a course set up at the North Carolina State College early last year, designed to give students fundamental knowledge of the principles of plant protection and to prepare them for jobs in the agricultural chemicals industry has not attracted a really encouraging number of candidates to take the course.

One of the needs of this, or any other industry, is trained personnel, and here is a great university trying to help train the personnel that the pesticide industry vitally needs. Yet the commercial firms and trade associations in the field, with all too few exceptions are doing little or nothing in the way of scholarships, fellowships, financial assistance or just plain recruiting and encouragement to channel prospective students into courses such as this.

Every industry today is automatically enrolled in a battle for brains, which will determine who will man its technical ramparts in the years ahead. If the pesticide industry can't somehow find a way to encourage and assist embryo entomologists and plant pathologists today, it will certainly face growingly serious personnel shortages in the years ahead.

* * * * *

THE high level of fertilizer consumption reached in 1960 is expected by the industry to continue in 1961, and may possibly exceed the 1960 volume. If no marked upsurge in demand occurs, however, the fertilizer industry, which will be starting the season with larger inventories than were on hand in 1959, may not quite attain the high level of production of the past year. Production of fertilizer materials increased considerably more than did consumption in 1960, probably because of the replenishing of inventories by manufacturers, distributors, and dealers after the heavy shipments of 1959.

Weather conditions, of course, will play a major role in determining whether or not 1961 will see a sales upturn. Last year at this time prospects were most favorable, but adverse weather in the spring of 1960 delayed planting and slowed early fertilizer sales. Demand picked up rapidly as the weather improved, and late sales eventually made up for the slow start, but the anticipated peak never was reached.

Another major barometer of fertilizer sales, farm income, also can be expected to play a part, although its effect on fertilizer use seems to be lessening. Farm income, which declined

(*Continued on Page* 91)

CROP RESPONSE

TO GRANULAR VS. FINELY DIVIDED FERTILIZERS

There is little difference in the agronomic effects of granular vs. fine nitrogen and potassium fertilizers because of the high solubility of most of these fertilizers in the soil. The problem of granule size with various phosphate salts, however, is much greater and more complicated. Phosphate salts vary from high water solubility to very low water solubility and even to low citrate solubility.

If the effects of granulation on crop response to each component of a fertilizer are considered separately, most experimental results become more meaningful.

by G. L. Terman

Soils and Fertilizer Research Branch, Division of Agricultural Relations, TVA, Wilson Dam, Ala.

WELL-GRANULATED fertilizers have obvious advantages in physical condition over nongranular materials, such as greater ease of flow in applicators, absence of dustiness, less tendency to absorb moisture and less caking in storage. Agronomic advantages often are not so obvious, and various published results of experiments are not all in agreement. This is particularly true of experiments which were not designed to separate the agronomic effects of granulation of each nutrient component of the fertilizer. However, if the effects of granulation on crop response to each component of the fertilizer are considered separately, then most of the published results become more meaningful.

Effects of Granulation on Response to Nitrogen

THERE is little or no agronomic problem in regard to granule size of common nitrogen fertilizers, because of the high solubility of most nitrogen salts and their high mobility in soils. Thus, immediately after application to a moist soil, there will be a high concentration of nitrogen around the granule, but it will soon dissolve and diffuse into a relatively large volume of soil. Granule size of nitrogen fertilizers such as ammonium nitrate, nitrate of soda or ammonium sulfate should be the size range which is best for storage, handling and application.

Oxamide $(CONH_2)_2$, containing 32 per cent N, has been found by TVA agronomists (3) and others to exhibit a granule size effect on availability to plants. Nitrification of the nitrogen in oxamide and its effect on plant response was found to increase directly with increase in surface area of granules in the range of -60+100 mesh sizes. Although oxamide may not, because of cost, become a commercially-used nitrogen fertilizer, these studies have demonstrated the principle of controlling the availability of a potential nitrogen fertilizer through regulation of its granule size. Ureaformaldehyde preparations also have been found to exhibit similar, but less pronounced granule size effects.

Effects of Granulation on Response to Potassium

AS is the case with common nitrogen fertilizers, little difference has been found in the agronomic effects of granular *vs.* fine potassium fertilizers commonly used, such as potassium chloride and potassium sulfate. These also have high solubilities. Potassium tends to be less mobile in the soil than nitrogen, since much of an applied potassium fertilizer is fixed by the clay minerals in slowly soluble forms which are largely available to crops. No conclusive evidence has been found that differences in granule size over the range commonly encountered in fertilizers have a consistent effect on crop response.

Fused potassium phosphates produced experimentally by TVA have been found to vary in availability to plants with rather wide variations in granule size. For example, granules of potassium metaphosphate and potassium calcium pyrophosphate, one-fourth inch or larger in size, were found to be much more slowly available to corn than fine materials. Residual effects of the coarse materials were much greater for the third successive crop. These experiments carried out by TVA agronomists indicate the possible use of large granules of the fused potassium phosphates as sources of phosphorus and potassium for shrubs, trees, and other horticultural uses.

Effects of Granulation on Response to Phosphorus

THE problem of granule size with various phosphate salts is much greater and more complicated than with nitrogen and potassium. The problem of granule size of NP, PK, & NPK fertilizers in relation to its effect on crop yields is largely related to the phosphorus component. Phosphate salts vary from high water solubility (monoammonium, diammonium, and monocalcium phosphates) to very low water solubility (dicalcium and tricalcium phosphates) and even to low citrate solubility (fluorapatite in rock phosphates). Consequently, one must specify the phosphate salts present in the granule in discussing availability to crops. Highly ammoniated superphosphate-based fertilizers and nitric phosphates usually contain complex mixtures of ammonium, monocalcium, and dicalcium phosphates and apatites.

Lawton *et al.* (4) found that when granular 12-12-12 fertilizers were mixed with the soil or banded, or when pulverant fertilizer was banded, crop response was closely related to the content of water-soluble-phosphorus in the fertilizers. These fertilizers were prepared from slurries of ammonium nitrate, ammonium phosphate, dicalcium phosphate, and potassium chloride. When the pulverant fertilizer was mixed with the soil, however, crop response was not related to water solubility of the phosphorus. In the case of the granular fertilizers and banded pulverant fertilizers, accompanied by limited reaction with the soil, crop response was related to a measurable fertilizer property (water solubility of the phosphorus). In the case of pulverant fertilizer mixed with the soil, this property was apparently obscured by reaction with the soil, resulting in reaction products similar in availability to the crop.

Similar results were reported by Terman *et al.* (5), who found that early growth response to phosphorus, as determined in greenhouse pots with oats and Sudangrass, and in the field with wheat forage and other crops, increased with increase in size of granules of NPK fertilizers high in water-soluble phosphorus (prepared with diammonium phosphate or ammoniated concentrated superphosphate). Early response also increased with decrease in size of granules low in water-soluble phosphorus (prepared with dicalcium phosphate or ammoniated ordinary superphosphate). The pronounced effect of granule size on early response did not always persist in final yields of corn or wheat in most field experiments. In general, however, the results indicated that for best crop response, fertilizers having a low water-soluble phosphorus content should be finer than those having a high content of water-soluble phosphorus.

When granular 12-12-12 fertilizers were mixed with the soil or banded, or when pulverant fertilizer was banded, crop response was closely related to the content of water-soluble-phosphorus in the fertilizers.

Later, in greenhouse pot experiments, Terman *et al.* (6) determined crop response to phosphorus in several nonammoniated and ammoniated ordinary and concentrated superphosphates, and in dicalcium phosphate. Heavy ammoniation decreased the water solubility of phosphorus in ordinary superphosphate from 70 to 14% and in concentrated superphosphate from 89 to 57%, chiefly because of conversion to dicalcium and more basic phosphates. With band application, yields of dry matter and of phosphorus with the ammoniated superphosphates were closely related to the amount of water-soluble phosphorus applied; but other than for dicalcium phosphate, granule size was of little importance. With phosphates mixed throughout the soil, both water solubility and granule size of the phosphates greatly influenced yields on most soils. Response decreased with increasing time of reaction (3 and 6 months) of the superphosphates with soil prior to cropping. Decrease in response with time was much less with granular than with fine superphos- and dicalcium phosphate.

In greenhouse pot experiments, Bouldin *et al.* (2) determined response of oats to various granule sizes of dicalcium phosphate, monoammonium phosphate, and mixtures of the two, which are commonly found in ammoniated superphosphates and nitric phosphates. As in previous studies, plant response decreased with increasing size of the water-insoluble dicalcium phosphate but increased with increasing size of water-soluble monoammonium phosphate. Granule size effects of mixtures of the two phosphates were intermediate between those for the single components. The important fertilizer properties were found to be geometric surface area (dicalcium phosphate) and water-soluble phosphorus content per granule (monoammonium phosphate). As granule size was reduced, plant response to all sources approached a common level, indicating that all finely divided granules had reacted with the soil, and that the plants were obtaining the phosphorus from the fertilizer-soil reaction products. Also, results with two successive crops indicated that as length of cropping increased, both granule size and source effects became less pronounced.

Bouldin and Sample (1) reported conclusive evidence of the direct relationship between plant

(*Continued on Page* 97)

Northeastern Weed Meeting

New Materials Show Promise For Weed Control in Vegetables

Promising weed control developments took place during 1960 in the areas of vegetable and nursery crops, brush, and orchards—particularly with respect to granular compounds. In addition, new uses for many of the older compounds have been developed.

Among promising new compounds are: Amizine, Dacthal, Hercules 7175, Amitrol-T, and Dicryl. All are reported on favorably at the 1961 meeting of the Northeastern Weed Control Conference.

THE development of promising new compounds for weed control and new uses for many of the older compounds continued at a rapid pace during 1960, according to reports presented at the 15th annual meeting of the Northeastern Weed Control Conference, January 4 to 6, at the Hotel New Yorker, New York.

A summary of the 1960 season was presented by Stanford N. Fertig, professor of agronomy, Cornell University, Ithaca, N. Y., who said that new and promising developments took place in the areas of aquatic weed control, vegetable and nursery crops, brush control, and air application — particularly with respect to granular compounds. Dr. Fertig reported on a total of 38 new chemicals. Amiben (3-amino, 2,5-dichlorobenzoic acid), in the liquid amine formulation as a pre-emergence treatment, looks very promising, he said, for annual broad-leaved and annual grass control at 3 to 4 pounds per acre on carrots, black-eyed peas, lima beans, and soybeans. The granular formulation has looked promising on crucifers, peppers, sweet potatoes and ornamentals, he added, at rates of 3 to 8 pounds per acre.

Amizine, a mixture of amitrol and simazine, looks promising for general vegetation control at rates of ten to 12 pounds active per acre, Dr. Fertig reported. He also reported a marked increase in the activity of Amitrol-T (amitrol-ammonium thiocyanate mixture) over Amino Triazole in the powder formulation. It is more effective, he said, on cattails, milkweed, leafy spurge, and cypress spurge than the powder and is equally effective on Canada thistle, hoary cress, and perennial sow thistle. Amitrol-T at two pounds per acre as a plow-down treatment followed by Atrazine at two pounds pre-emergence looked excellent for quackgrass control in corn. He added that early post-emergence cultivations are essential for good control.

Dacthal (dimethyl 2,3,4,6-tetrachloro teraphthalate), he continued, has received many favorable reports as a pre-emergence treatment of weed-crop situations at rates of 4 to 12 pounds active per acre. Among the crops on which favorable results were received with the compound were lima beans, onions on mineral soils, transplanted peppers, tomatoes, broccoli, field corn, and soybeans.

Dr. Fertig reported that Dicryl (N - [3,4 - dichlorophenyl] methyacrylamide) has been promising as a post-emergence herbicide for carrots, celery, and gladioli. Analogs of Eptam — such as R-1607 (n-propyl ethyl - n - butylthiolcarbamate) — have shown excellent activity against a number of weed species, he continued. Soil-incorporated treatments at rates of three to six pounds active per acre may find a place on such crops as beans, beets, corn, crucifers, spinach, tomatoes, and tobacco, he said.

Hercules 7175 is reported to have shown promise for pre-emergence weed control in white potatoes, he said. Seasonal control of vegetation has been obtained with rates of 20 to 40 pounds per acre.

For the control of broad-leaved weeds and annual and perennial grasses, he said, the Triazines have shown outstanding promise.

In 1959 several herbicide treatments appeared promising in Pennsylvania for the weeding of carrots in addition to the recommended chemical, Stoddard Solvent. Charles J. Noll, Pennsylvania State University, reported on a continuation of this work. During 1960, he said, all chemicals tested gave highly significant increases in weed control as compared to the check. Two chemicals, Colan and Karsil at all rates, gave highly significant increases in weed control as compared to the Stoddard Solvent treated plot. While no treatment significantly increased the stand of carrots, he said, three chemicals, Stoddard Solvent, Dicryl, and CIPC, significantly reduced the stand of carrots as compared with the untreated check plots. Yields, however, were at least doubled in 70 per cent of the treated plots as compared with the check. Dr. Noll said that the best treatments were Solan and Karsil, applied at the time the carrots had their first true leaves.

In experiments reported by M. F. Trevett and William Gardner, University of Maine, it was concluded that ten pounds of Zytron per acre, 4 to 8 pounds of Dacthal, and 4 pounds of Amiben

show promise for preemergence application in carrots. Zytron, in the Maine tests, was regarded as outstanding. In post-emergence tests in carrots, Solan, Dicryl, and Karsil, at rates from 3 to 6 pounds per acre, did not differ significantly in effect on yield, stand, or average weight per topped carrot. Karsil, however, gave numerically lower yields than either Solan or Dicryl, they added.

Although maleic hydrazide has been tested from time to time as a material for weed control in cranberries since shortly after World War II, the chemical has shown little promise either in assisting the early coloring of the fruit or controlling such annual grasses as Digitaria and Aristida. C. E. Cross and I. E. Demoranville, University of Massachusetts, however, reported on recent studies which indicate that a treatment of 15 pounds actual MH-30 per acre applied in late July or early August kills over 90 per cent of wild bean and rice cutgrass, and does this essentially without injury to cranberry vines. Application of the chemical in April retarded bud development to some extent over a period of 3 to 4 weeks, but actual blooming time was delayed by one week or less, and the flowering and set of the cranberries appeared normal. In a few tests last year, late July treatments with MH actually showed an increased production of cranberries in the fall of 1960, it was reported.

Frank N. Hewetson, Pennsylvania State University, reported on work conducted during the past season at the Fruit Research Laboratory, Arendtsville, Pa., where herbicides were used to control weeds around young apple trees. The successful establishment of an apple orchard is closely associated with the growth of the trees during their first few years in the orchard. The products used in the experiments were Amitrol T, Dalapon (2,2-dichloropropionic acid), and Simazine (2-chloro-4, 6-bis *ethylamino*-s-triazine). Dr. Hewetson said that the results of the experiment indicate that the use of Amitrol T and Simazine combination sprays, in a year of average rainfall, can be an effective practice in controlling weeds around young apple trees and, thus, in stimulating early development of the new apple orchard. The use of Dalapon by itself, or in combination with Amitrol T, gave little if any weed control. The predominant weeds around the trees, however, were broadleaf, which Dr. Hewetson said, would account for the poor showing of Dalapon, a grass or narrow-leaf herbicide.

Lawrence Southwick, project leader in the Agricultural Chemicals Development Section, The Dow Chemical Co., Midland, Mich., was elected president of the Northeastern Weed Control Conference at the 15th annual meeting.

Other officers named were: D. A. Schallock, weed control specialist, Rutgers University, vice president; P. W. Santelmann, assistant professor of agronomy, University of Maryland, secretary; and John Meade, assistant professor of agronomy, University of Maryland, treasurer.

More than 670 persons registered for the meeting, the highest attendance on record for the Northeastern Weed Control Conference.

A comparison of spray and granular applications of a number of herbicides for weed control in corn was made by Frank B. Springer Jr. and Richard H. Cole, University of Delaware. Their experiment indicates that the granular form of 2,4-D was fair in the control of broadleaf weeds at the rates used (one-half and one pound per acre), but unsatisfactory in grass control. CDAA-T (solution), CDAA-T granular, and Atrazine granules gave very effective control of both broadleaf weeds and grasses in tests conducted at Newark, Del., but CDAA-T granular was not effective on either broadleaf weeds or grasses in tests conducted at Georgetown, Del.

With the exception of 2,4-D granular, the granular herbicides used in the test did not seem to be more effective in controlling weeds than the same herbicides applied in solution, the Delaware agronomists reported. The granular form of 2,4-D was slightly more effective in controlling broadleaf weeds and grasses than was 2,4-D in solution, they said.

Richard D. Ilnicki and C. Fred Everett, Rutgers University, New Brunswick, N. J., also reported on comparisons of granular or liquid herbicides. They studied the effects of several carriers of 2,4-D and its formulations and observed that, in general, granular 2,4-D preparations, both of the esters and amines, produced slightly better weed control but caused greater injury to corn than the liquid preparations. In addition, they said, a slow disintegrating granule was superior to a fast disintegrating granule, but yield reductions were less with the latter.

Factors influencing the performance of granular herbicides were covered by R. D. Sweet, Cornell University, who said that the chemical itself has an important bearing on results. Certain compounds, such as EPTC, almost always give better results in a granule, he pointed out. On the other hand, he continued, Atrazine at lower rates performs better as a wettable powder. The nature of

(*Continued on Page* 95)

Phosphoric Acid Use On Increase

Among reasons for increasing phosphoric acid use in fertilizer production are: the trend toward higher analysis fertilizers, development and growth of liquid fertilizers, improved plant design, and good storage properties of fertilizers made with phosphoric acid.

USE of phosphoric acid as a raw material in fertilizer manufacture has increased steadily, observed William Weber, Dorr Oliver Co., Stamford, Conn., at the 10th Fertilizer Industry Round Table Nov. 3 to 5 in Washington, D. C.

Current annual production is estimated at some 2.6 million tons of P_2O_5, he reported. Among the reasons cited for the increasing use of phosphoric acid in the fertilizer industry were: (1) the trend toward higher analysis fertilizers; (2) development and growth of liquid fertilizers; (3) improved plant design; and (4) good storage properties of fertilizer compounds made from phosphoric acid.

Discussing the various types of phosphoric acid, Mr. Weber pointed out that normal, wet process acid contains about 32% P_2O_5 and needs to be concentrated. The impurities in wet acid are not necessarily objectionable, although they will affect the fertilizer grade. Free sulfuric content, for example, will increase the acidity of the acid, affect ammoniation rate, as well as the acidulation rate and grade of product. Fluorine impurities in wet process acid have similar effects. Insoluble products in the acid present the problem of sludge formation in storage and handling.

Superphosphoric acid was defined as containing about 76% P_2O_5 (commercial wet process acid contains about 68% P_2O_5). The super and wet process phosphoric acids contain P_2O_5 in the form of condensed phosphates which have the property of complexing Ca^{++} and Al^{+} ions.

Use of furnace grade phosphoric acid in mixed fertilizer production was reviewed by Mel Leach, Indiana Farm Cooperative, who related some of the experiences of his company. Magnetic meters are particularly satisfactory in metering phosphoric acid, or any grade product, he reported. A positive displacement meter can also be used, he said, but corrections must be made for changes in viscosity. Mr. Leach confirmed the lack of uniformity in raw materials supplied the fertilizer manufacturer, and cautioned users to change production formulas in accordance with changes in formulation.

Rodger Smith, Eastern States Farmers Exchange, added his experiences in use of phosphoric acid to those of Mr. Leach, observing that phosphoric acid offers several advantages over sulfuric acid in granulation,—that these advantage account partly for the 60% increase in phosphoric acid production over the past three years. Among the advantages listed for use of phosphoric over sulfuric acid in granulation were: better granulation; increased concentration, and less formation of noxious compounds. On the other hand, added Mr. Smith, the heat of reaction is ⅓ less with phosphoric acid than with sulfuric acid. Adjustment of temperature or water content, however, will compensate for the lower heat of reaction.

The speaker reported also that use of phosphoric acid allows for ammoniation at higher levels than commonly employed with ordinary superphosphate. Because of the water content of phosphoric acid, low water content nitrogen solutions may be used—an advantage in making high nitrogen grades of fertilizer. A typical formula for an 8-16-16 fertilizer given as follows:

solution 440	386
phosphoric acid	140
triple super	236
R/P super	706
muriate of potash	499
Sul-P-Mag	110
borate	3
	2080

In discussing the storage and handling of phosphoric acid F. M. Batson, General Chemical Div., Allied Chemical Co., reported:

1) rubber lined tanks can be used very successfully,—these cost 40-50¢ per gallon plus installation, but should last 20 years or so. The speaker advised that General Chemical has sold and stored muriatic acid in rubber lined tanks, and is satisfied with their performance.

2) #316 stainless steel (3/16" plate or more) is subject to attack by wet process phosphoric acid, and costs about $1.00 per gallon plus installation.

3) a PVC (polyvinyl chloride) bonding to steel costs more than a rubber lined tank. Performance has been reported as satisfactory.

4) a plastic bag as a loose liner is reportedly less durable than other storage materials, — cost ranges between 20-25¢ a gallon.

5) some success has been reported in using an open top plastic liner for phosphoric acid storage. It is necessary, of course, that the tanks themselves be free of rough edges.

6) pool type storage provides a larger-volume, low-cost unit, averaging 5-10¢ a gallon. The site for such a pool must be free of ground water problems, and allow for drainage. A cover is recommended, to eliminate resin and foreign materials. The lining of the pool itself is usually of asphalt and burlap.

Mr. Batson indicated that his experience with this type storage unit is limited, but that one such pool in use for about a year has so far proved excellent.

It was suggested that pipe lines should average 1½"-2" in diameter. This size does not present a cleaning problem resulting from deposits in the pipe. If pipes do become clogged, it was recommended that hot water be forced through. If this does not work, it is then necessary to dismantle the pipes and clean them physically.

Ammonium Phosphate Production in Conventional Equipment

A RECENT upsurge of interest in DAP and increased inquiries on how DAP grades or grades rich in DAP can be made in a continuous ammoniator, stimulated studies at TVA on such production methods. A. Phillips, chief, Process Engineering Branch, TVA, reported on these to the Fertilizer Industry Round Table. Grades of DAP produced at TVA, he advised, have ranged from 21-53-0 to 18-46-0, depending on the amount of impurity in the free acid. The higher grade, he added, was made with electric furnace acid. He also indicated that in some runs, potash was added to make a 14-35-14 grade.

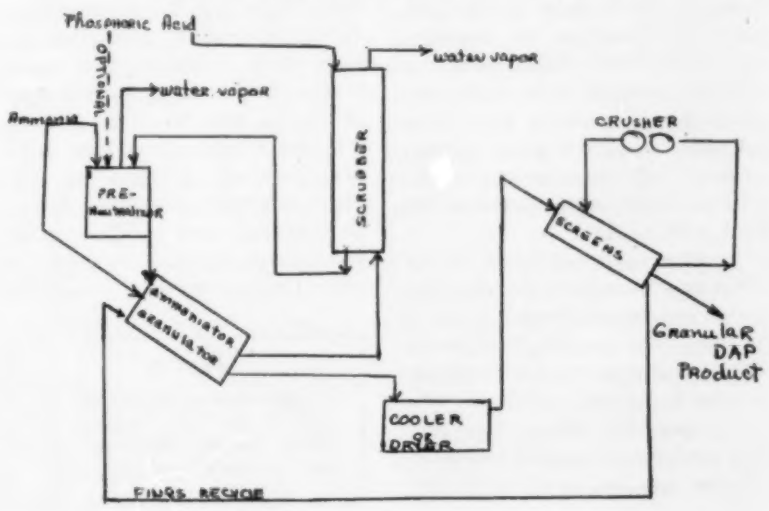
"We have a standard continuous ammoniation plant," advised Mr. Phillips, and for production of DAP there are two major additions: a preneutralization tank feeding the ammoniator, and a scrubber to recover the ammonia from the ammoniator exhaust. (A flow sheet of the TVA process is shown on this page). In the preferred method of operation, all the phosphoric acid is fed to the scrubber. Effluent from the scrubber is pumped to the preneutralizer, where it is partially neutralized with ammonia. The slurry from the preneutralizer (a mixture of monoammonium and diammonium phosphate) flows to the ammoniator-granulator, where it is distributed on top of a bed of recycled fines. Ammonia is added underneath the bed to complete the neutralization to DAP. This takes some excess ammonia, which is recovered in the scrubber by the incoming acid. The product from the ammoniator is dried mildly in a rotary dryer and screened. Oversize is crushed in a chain mill and rescreened. The undersize is returned to the ammoniator.

Data from a typical pilot plant operation given by Mr. Phillips follows:

Feed Rate lbs/ton	
Phosphoric acid (46% P_2O_5)	2050
Water	395
Ammonia to preneutralizer	281
Ammonia to ammoniator	202
Preneutralizer	
NH_3 to H_3PO_4 Mol Ration	1.29
Slurry Temperature °F	237
Slurry Moisture %	21.0
NH_3 Loss % of Total Feed	2.5
Ammoniator	
NH_3 to PO_4 Mol Ratio	2.00
Temperature °F	188
Recycle Ratio lbs/lbs prod	2.2
NH_3 Evolve, % of Total Feed	5.2
Product Analysis	
Nitrogen	18.5
Available P_2O_5	47.2
Moisture	1.7
Overall NH_3 loss (including dryer)	6.1

In making a 14-35-14 grade, KCl was added to the ammoniator.

Flow sheet of the TVA process for producing DAP.



W. Law, Minneapolis - Honeywell Co.; W. Strauss, Foxboro Co.; D. Warren, Omega Machine Co.; and A. Simmons, Fischer & Porter Co.

Standing: D. J. Bourne, duVal Sulphur & Potash Co.; N. T. Wendt, American Potash & Chemical Co.; D. R. Gidney, Potash Co. of America.
Seated: Van Rogers, Southwest Potash Co., R. R. Heck, International Minerals & Chemical Co.; and E. Kapusta, U. S. Borax.

Only change in operations was to reduce the recycle ratio to 1.5:1.0

The preneutralizer, used in the TVA process described here, is a stainless steel tank, 14 inches in diameter and 3½ feet high. Important points in the preneutralizer operation are: (1) To control ammonia rate, to maintain a mol ratio of NH_3 to H_3PO_4 of 1.3, since the ammonia loss becomes rather excessive at higher mol ratios. (2) The slurry leaving the preneutralizer should contain 15 to 25% water. This will be the moisture content if not more than about 15 to 40% P_2O_5 is fed to the process,—or enough water is added to dilute the acid to this concentration. Evaporation of water in the preneutralizer controls the temperature at 235-250°F. When liquid anhydrous ammonia is fed to the preneutralizer, experience shows it is advisable to add a small amount of water with the ammonia,—otherwise the slurry in the bottom of the tank will solidify.

Other operation factors in the TVA process indicate that the minimum recycle rate should be 2 or 3 to one. The recycle requirement increases sharply when acid concentration is decreased from the 40% P_2O_5 specified. When 32% acid was used, recycle required for granulation was 8½ to 1; with 35% acid, recycle requirement was 5 to one.

The gas rate from the ammoniator to the scrubbing tower is 359 cubic feet per minute. Water content of effluent from scrubber is about 35%, effluent is added to keep packing wet, at about 10 gallons/minute.

Dryer (counter current) product is maintained at 180-210°F. Ammonia loss from the dryer ranges between 2 to 4%, increasing as dryer temperature is increased. The product is screened at 6 by 10 mesh.

The finished product of the TVA pilot plant had good physical properties after three months storage in 2-ply asphalt laminated bags. When the product was dried to less than 1.0% moisture, the stored product had no lumps after 1 drop of the bag, even when the product was unconditioned. When dried between 1 and 1.6% moisture, condition was fairly good even without conditioner, – and excellent when conditioned with 2.0% dolomite or clay. Undried material with 2.2% moisture was satisfactory when conditioned.

PART IV
of Agricultural Chemicals' report of the 10th Fertilizer Industry Round Table will appear in the March issue.

Clem Giles, California Spray Chemical Corp., described several Calspray plants using the PEC reactor and PEC drying system. He reported that PEC reactors have been used to make ammophos of 16-48-0 and 18-46-0 grades. Once PEC reactors are installed to produce nitrophos, he observed, it is certainly easy and efficient to produce the ammophos with the same system.

The PEC system, he reported, consists of three basic stages: acidulation, ammoniation and the addition of potash. In acidulation, two or three reactors are used, depending on the rate and retention time required by the rate at which phosphate rock is fed from some form of controlled weighing facility into the reactor and nitric acid is fed into the reactor. Whenever it is desirable to increase production, it can be accomplished by adding more reactors to the train.

Nitric acid acidulates the phosphate rock, making the P_2O_5 available in the dicalcium form, which is the citrate-soluble P_2O_5. Present also is calcium nitrate, which if left in the product, would produce a highly hygroscopic salt which could not be stored in bulk. Therefore, calcium nitrate has to be either removed or converted. In the PEC process, this calcium nitrate is either converted to dicalcium phosphate by the addition of phosphoric acid,—or to calcium sulfate by the addition of sulfuric acid,—or to calcium carbonate by the addition of CO_2. Phosphoric acid or sulfuric acid is added gradually to each of the remaining reactors, together with ammonia. End result is ammonium nitrate, dicalcium phosphate, some ammonium phosphate, and if sulfuric acid used—some dicalcium phosphate.

Mr. Giles described operations at the Calspray fertilizer plant in Kennewick, Washington, which was formally dedicated earlier in 1960 (see story and flow diagrams in June, 1960 *Agricultural Chemicals*, page 46).

Current and Prospective Situation Affecting Use of Agricultural Chemicals

The proper and safe use of agricultural chemicals is of deep concern to the U. S. Department of Agriculture, starting with the research man who studies a chemical's usefulness and extending through to the time the chemical becomes an instrument for farm production. Millions of dollars have been spent on the study of pesticides with one objective — to provide a safe and adequate supply of food and fiber at a reasonable cost.

Also discussed at cotton conference were the North Carolina cotton pest control program and control of wilt and nematodes.

IN the United States, the score or so of accidents attributed to pesticides are statistically insignificant when compared to the four million home accidents that cause approximately 28,000 deaths annually, Dr. H. L. Haller, assistant to the administrator, Agricultural Research Service, USDA, told the Beltwide Cotton Production-Mechanization Conference, Greenville, S. C., January 11 to 13, 1961. Dr. Haller added, however, that this does not mean that pesticide users can be complacent. "Precautions," he said, "must be observed."

The proper and safe use of agricultural chemicals, Dr. Haller continued, is of deep concern to the Department of Agriculture. This concern begins with the research man who studies a chemical's usefulness and it extends through to the time the chemical becomes an instrument for farm production.

Referring to the future of pesticides, Dr. Haller said that chemicals are here to stay. Farmers have come to rely on them to protect crops and livestock from insects, diseases, and weeds, and to increase the efficiency of farm operations in many other ways. They are an essential production tool, he added, and we have no present alternative to their use.

But we must search for more efficient ways to use them, Dr. Haller cautioned. We must continue to look for new chemicals that have a wide margin of safety. And we must, he added, continue to look for new control techniques that can be used alone or with chemicals. He said also that greater emphasis needs to be placed on the use of chemicals in the weakest link of the life cycle of insects.

Dr. Haller said that, in following up every promising new lead, scientists are exploring many challenging areas. He cited such developments as biological controls, insect sterility, attractants, and repellents as possible substitutes or aids to chemical control that may be used in sensitive areas.

In the meantime, he stressed, no other country in the world has the comprehensive laws and enforcement procedures that insure the safe use of chemicals for food production and distribution in the United States. Many of the newer pesticides used in the United States, he added, are commonly used in Europe also.

The past decade in the U. S., Dr. Haller continued, has seen the development of the world's most extensive body of research data on all aspects of pesticides. Much of this stems from the highly dynamic and progressive nature of the agriculture of the United States, and the large and necessary role of pesticide chemicals, he said. It is unlikely, he added, that any other country will ever approach the magnitude of U. S. research on this topic. Millions of dollars have been spent on study of pesticides, and many billions more will be spent in the future, he predicted. All this concentration of research, money, time, and energy has only one objective, Dr. Haller said, to provide a safe and adequate supply of food and fiber at reasonable cost.

The program for pesticide safety endorsed by the Federal

(*Continued on Page* 96)

"Agricultural chemicals are here to stay . . . and we have no present alternative to their use. But we must search for more efficient ways to use them and we must continue to look for new chemicals that have a wide margin of safety."

Dr. H. L. Haller
Assistant to the Administrator
Agricultural Research Service, USDA

European Fertilizer Technology*

In spite of the relatively high cost of raw materials, European fertilizers compete quite successfully on the world market. The main reason seems to be that high raw material costs are more than offset by economies in large-scale, integrated operations, improved technology, and selection of the most economical processes.

In addition, European manufacturers limit the number of fertilizer grades and concentrate their efforts on improving the quality of these grades. Most U. S. companies, however, feel that they must have many grades available, although most agronomists agree that only a few grades are necessary in any given farming area.

by T. P. Hignett
Tennessee Valley Authority
Wilson Dam, Alabama

MOST fertilizer manufacturers consider it well worth while to learn as much as they can about developments in their field by visiting other plants and attending technical meetings in the United States. Very few, however, have made a serious effort to inform themselves about technical developments in Europe. European technologists frequently visit the United States to learn about our developments. This need not be a one-way flow for there is much to be learned in Europe; in fact, many, perhaps most, of our present fertilizer production processes originated in Europe.

Most companies in Europe publish little technical information on their production methods or research. Therefore, the best way to get this information is by visits. Last fall the author spent seven weeks in Europe and visited twenty companies that manufacture fertilizer in seven countries—England, Scotland, Sweden, Germany, Holland, Belgium, and France. These companies manufacture more than half of the fertilizer production in their countries so the information obtained should be representative of technology in those countries.

The trip included attendance at the technical meetings of the International Superphosphate Manufacturers' Association in Stockholm at which 140 delegates from twenty countries all over the world met and papers were presented on a wide range of subjects dealing with the manufacture of phosphate fertilizer and mixed fertilizer.

Fertilizer use has increased greatly in Europe. For instance, it was said that the annual consumption in Great Britain has tripled since the last war. As a result of the increased use of fertilizer and other factors, the food sufficiency of Great Britain has increased from 45 to about 80%, even though the population has increased from 40 to 56 million. The amount of fertilizer used per acre is several times greater in most European countries than in the United States.

Raw materials for fertilizer manufacture generally are expensive in Europe. Phosphate rock is imported, mainly from Africa and the United States. Sulfuric acid is produced from imported sulfur or pyrites. Nitrogen fertilizer materials are produced mainly from synthetic ammonia. The hydrogen for ammonia synthesis is produced from coal, coke oven gas, or imported oil, all of which are relatively expensive.

In spite of the relatively high cost of raw materials, European fertilizers compete quite successfully on the world market. It appears that high raw materials costs are more than offset by economies in large-scale, integrated operations, improved technology, and selection of the most economical processes.

Most of the plants produce from 100,000 to 500,000 tons of mixed fertilizer** per year and seldom are more than five grades made in one plant. Sometimes the entire production is a single grade. This practice contrasts sharply

*Paper presented at the 138th national meeting of the American Chemical Society in New York City, September 11-16, 1960.

**The term "mixed fertilizers" is used in this paper to denote all fertilizers containing two or more of the primary plant nutrients (N, P_2O_5, and K_2O), whether made by mechanical mixing of fertilizer materials or by integrated processes from basic raw materials.

with mixed fertilizer production in the United States; the annual production of a typical American plant is about 20,000 tons and may consist of fifty or more grades. The hourly production rate of the European plants is comparable with the American plants; 10 to 40 tons per hour is a usual rate. The larger annual production results mainly from continuous operation. Sufficient storage space is provided to permit continuous operation, even though the demand is seasonal. Restriction of the number of grades permits economies in operation, storage, and handling.

Most of the mixed fertilizers are granular; in some countries the proportion is as high as 95%. The quality of the granular fertilizer quite often is very good and probably is better than the average in the United States. Continuous, sustained operation and limitation of the number of grades are very helpful in attaining good granulation.

Fertilizer manufacturers in the United States might well consider the example of European manufacturers in limiting the number of grades and concentrating their efforts on improving the quality of these grades. Most agronomists agree that only a few grades are necessary for general farm use in any given area. However, the sales organizations of some companies feel that they must have many grades available. It is suggested that farmers might react favorably to a program of selecting a few grades that are the most economical for the farmer to use and of improving the quality of these grades rather than to manufacture a large number of grades.

Many European plants produce ammonia, ammonium nitrate, ammonium sulfate, and nitric acid and use these materials in mixed fertilizers. Some plants purchase ammonia and produce nitric acid; others purchase all nitrogen materials from nearby producers on contract. In either case, steady operation of the fertilizer plant provides a steady demand for nitrogen materials which ensures steady and, therefore, more economical operation of the nitrogen production facilities.

As in the United States, the trend is toward higher analysis fertilizers which are readily accepted by farmers in some areas and not so readily accepted in other areas. Typical high-analysis grades are 20-20-0, 15-15-15, and 13-13-21. Some of the lower analysis grades are 6-12-18, 9-9-18, and 10-8-14.

In the past there has been considerable usage of single-nutrient fertilizers by farmers who would either apply them separately or mix them on the farm. This practice seems to be decreasing, and the proportion of factory-mixed fertilizers is increasing.

Superphosphate-Based Fertilizers

SOME plants produce granular fertilizers by granulating mixtures of ordinary or triple superphosphate and ammonium sulfate, ammonium nitrate, ammonium phosphate, and potash salts. In some cases, the superphosphates are ammoniated lightly. Heavy ammoniation is avoided, because it causes serious reversion of the phosphorus to a form not soluble in alkaline ammonium citrate solution, which is used in most countries to evaluate the availability of the phosphorus in fertilizers.

Ammonium sulfate has been the principal source of nitrogen in superphosphate-based mixed fertilizers. In order to increase the grade of the mixtures, some plants now use ammonium nitrate, either in the form of hot, concentrated solution or solid, crystalline form.

Granulation of superphosphate or superphosphate-based fertilizers usually is carried out in a horizontal rotary cylinder. A typical granulator may be 5 to 8 feet in diameter by 2 to 40 feet long and may rotate at about 12 revolutions per minute. There is a retaining ring at the feed end but none at the discharge end. Steam is used widely to assist in granulation. The steam is injected under or on top of the bed of material near the feed end of the granulator. Emphasis is placed on producing a high percentage of onsize in the granulator so as to decrease the percentage that must be recycled. In many cases, 75 to 85% of the product is onsize. Drying, cooling, and screening practices are similar to those in the United States, except that the screening usually is such as to yield a product of more uniform particle size. A typical product size is about 4-10-mesh Tyler screen size.

One plant was using a pin granulator for mixed fertilizers. This granulator resembled a single-shaft pugmill except that the blades were replaced with rods set radially in the shaft in a spiral pattern. The rate of rotation was rather more rapid than most pugmills. It was claimed that this unit would granulate mixtures at a lower moisture content than cylindrical granulators, and that the percentage of onsize fraction was unusually high. It was claimed also that the pin granulator would

Although European fertilizer technologists frequently visit the United States to learn about new developments, very few U. S. manufacturers have made a serious effort to inform themselves about technical developments in Europe.

This is despite the fact that many of our present fertilizer production processes originated in Europe.

perform efficiently on mixtures that are difficult to granulate in cylindrical granulators such as mixtures containing a high proportion of crystalline materials.

When ordinary or triple superphosphate is granulated alone, it usually is granulated immediately as it comes from the den. In some plants the superphosphate from the granulation step is dried to 4 to 6% moisture. However, in other plants it is cooled but not dried, and in still other plants it is neither dried nor cooled. An inclined pan granulator was used in one of the plants for granulating superphosphate.

Ammonium Phosphate and Nitric Phosphate Fertilizers

THERE is a very strong trend toward the production of mixed fertilizers without the intermediate production of superphosphate. In England and Scotland where strong emphasis is placed on water solubility of phosphorus, ammonium phosphate sulfate and ammonium phosphate nitrate processes are coming into use. A typical grade of ammonium phosphate sulfate is 12-12-18. One company has recently begun production of 17-11-22, presumably an ammonium phosphate nitrate product.

On the continent, nitric phosphate processes are gaining ground rapidly, and many new plants of this type have been or are being built in nearly all European countries. Some of the new plants were built by companies that previously produced only nitrogen materials and some by companies that previously manufactured only superphosphate-based mixtures.

At least eight different nitric phosphate processes are in large-scale use. These are the Auby, Dutch State Mines, Kampka, Norsk Hydro, Odda, PEC, St. Gobain, and TVA processes. Some of these processes have several variations which may be designated phosphonitric, sulfonitric, or carbonitric. The TVA process is the only one in which ammoniation is carried out in the solid state; the TVA ammoniator-granulator is used for this step. The TVA process, or modifications of it, are known to be in use in three plants, and a fourth plant is being constructed. In addition to these processes that are in commercial use, several others have been or are being developed in laboratory or pilot-plant equipment.

In three of the processes (Dutch State Mines, Odda, and Norsk Hydro), phosphate rock is dissolved in nitric acid, and the solution is then cooled to crystallize calcium nitrate or calcium ammonium nitrate which is removed by centrifuging. As much as two-thirds of the calcium may be removed in this step. The remaining solution is then ammoniated, and the resulting slurry is granulated with addition of potash salts to make grades such as 20-20-0, 15-15-15, and 12-12-21. The calcium nitrate is granulated or prilled and is sold separately, or it is converted into ammonium nitrate by reaction with ammonia and carbon dioxide.

These calcium nitrate removal processes have the advantage of the lowest raw materials cost and good-quality, high-analysis products, However, much expensive equipment is required. The technology of the calcium nitrate removal step was said to be difficult. The kind of phosphate rock used was critical. The market for the calcium nitrate coproduct may be a determining factor with respect to choice of these processes.

In one variation of the Auby process the nitric acid–phosphate rock solution is neutralized with basic slag (which contains up to 20% P_2O_5); no ammonia is used.

With the foregoing exceptions, all other nitric phosphate processes make use of phosphoric acid, sulfuric acid, or carbon dioxide to combine with part of the calcium that is brought in by the phosphate rock. Typical grades made by the phosphonitric method are 10-15-20, 15-15-15, and 13-13-21. The sulfonitric method can produce grades such as 6-12-18. 9-9-18, and 13-13-0. One grade made by the carbonitric method is 10-8-18. Various combinations of sulfuric, phosphoric, and nitric acids may be used to make other grades.

The various processes are chemically similar; differences are concerned mainly with equipment and operating procedure except as previously mentioned. Many of the processes are flexible, and formulations can be changed to provide a variey of grades. Ammoniation is carried out in a series of agitator tanks; the ammoniated slurry is granulated in pugmills or similar equipment and is controlled by recycling of dried product. Exceptions are the TVA process in which ammoniation and granulation are carried out in the TVA ammoniator and the Dutch State Mines process in which the ammoniated slurry is evaporated to a very low moisture content and is then flaked on a water-cooled drum. The flakes become rounded granules during drying.

Water Solubility of Phosphorus

EMPHASIS on water solubility of phosphorus in fertilizers varies widely. In England and Scotland, water solubility is the principal method of evaluating the effectiveness of phosphorus in fertilizers so the water solubility is kept as high as possible. In other countries, many of the nitric phosphate manufacturers control the water solubility at some level in the range of 25 to 50% of the total phosphorus. However, some companies make nitric phosphates that have no appreciable water-soluble phosphorus content. European farms in general are fertilized much more heavily than ours; consequently the phosphorus content of the soils usually is high. Under these conditions it appears that water solubility of the phosphorus in fertilizers is not particularly important.

The quality of the water-insoluble phosphorus in fertilizers gen-

(*Continued on Page* 100)

Development of Research In Plant Nematology

There currently is a lack of information concerning not only distribution and host ranges of nematodes, but also the degree of plant injury that may be caused by any particular population. Life cycles and other bionomical information lack considerable detail.

The development of control measures may be expedited through clarification of taxonomy and the finding of possible weak spots in life cycles. Research concerning parasitism and pathogenicity also is needed in order to determine more accurately when and where crop damage occurs.

PLANT nematodes definitely constitute a limiting factor in crop production in Florida. Losses in crop production up to 100 per cent occur, within fields or portions of fields, all too frequently, particularly on the sandy soils. Normally, of course, the losses are much less, but it must be remembered that diagnosis of nematode injury may be difficult.

There is no means, at present, whereby one can accurately estimate crop losses due to nematodes. There is a lack of pertinent information concerning not only distribution and host ranges of the species, but also the degree of plant injury that may be caused by any particular population. This is not too surprising when it is remembered that prior to 1948 no university in the United States offered formal courses in nematology. At the present time, however, most genera and thus practically all plant parasitic nematodes have been found and described. Some changes and/or clarifications are needed, of course, but for the most part, plant nematologists would be well advised to proceed very carefully when considering the establishment of new generic or higher category groupings. At present there exist several examples of controversial genera simply because some nematologists have proceeded with premature publication, or else did not ask advice of the more experienced personnel.

Life cycles and other bionomical information, while grossly described for most nematodes, lack considerable detail. Definite life cycles for many of the most important plant parasites await exploration. The development of control measures may be expedited through clarification of taxonomy and the finding of possible weak spots in life cycles. As an example, the stubby root nematode many times will not reach root-destroying population levels in the field until after one of the chemical nematocides has been used to control other species. There then occurs, after about two months, a population explosion so that increases of 1,000 times normal are common. Some unknown ecological or bionomical factor has been upset by the nematocide and nematologists must find the explanation for this most unusual and important phenomenon.

Research concerning parasitism and pathogenicity also is needed in order to determine more accurately when and where crop damage occurs. Feeding habits of many species presently listed as probable or suspected plant parasites must be determined. Consider for example the lance nematode and turf problems in Florida. This parasite commonly is found in large numbers in areas where turf is poor and it is assumed that the nematode incites the trouble. Actually, however, no pathogenicity tests have been conducted and, while there remains little doubt that lance nematodes are highly pathogenic to the grasses, actual data are lacking. This is only one example of hundreds of cases that nematologists are faced with annually. Future research into the modes of feeding and the inciting of plant diseases must be greatly expanded if the science is to be placed on firm ground.

Control of Nematodes

The first really useful chemical nematocides were introduced in 1945 and little improvement has been made since, except in the development of techniques for proper application. These nematocides have had a profound effect in expanding the science, however. Nematologists now have chemical tools with which they can determine when and where nematode diseases of plants occur and, of perhaps more importance, the effects of the nematodes can be demonstrated in the field to other research personnel and to the public. These nematocides, and later ones, are not infallible and their effects may extend far beyond the killing of plant nematodes. During wet and cold weather, for in-

(*Continued on Page* 96)

This article is based on an address by V. G. Perry, Professor of Nematology, University of Florida, Gainesville, at the 30th meeting of the Soil & Crop Science Society of Florida, Nov. 30, 1960.

At Portland, Oregon

Latest Western Pesticide Developments Told in Week-Long Series of Meetings

Among new compounds reported on favorably at a week-long series of meetings in Portland, Ore., are Guthion and Bayer 29493, which provided excellent control of codling moths on apples; Kelthane and Tedion, which controlled Mcdaniel mites; Volck Supreme oil, Penco Superior oil, Ethion, and Diaz-N-Oil, which provided excellent control of European red mites; and Sevin, which was effective against the bronze cane borer, among other pests. A disappointment to researchers was the apparent failure to control codling moths with bacterial spray.

by Loren H. Milliman

LATEST developments in plant and food protectants under test in the West were outlined for some 400 scientists and industry men in a week-long series of meetings in Portland, Ore., Jan. 16 to 20. Starting with the 20th annual Pacific Northwest Vegetable Insect conference, four different sessions intermeshed for an exchange of information.

The vegetable meeting ended at noon Jan. 18, with the morning being devoted to an open session where industry men heard summaries of discussions the scientists had conducted during the two previous days. That afternoon, the 35th annual Western Cooperative Spray Project, generally known as the Western Spray conference, and the 8th annual Western Agricultural Chemicals Northwest conference started meetings in the Imperial and Benson hotels, respectively.

One of the disappointments from a layman's standpoint was the apparent failure to obtain control of codling moths with bacterial sprays, which had looked promising last year.

Appearing bright on the horizon, however, are a number of products of the Bayer laboratories in Germany, still coded. One advantage of these new chemicals—as well as others—is that they have a rather wide spectrum of effectiveness. As at least one speaker pointed out, that will be one of the major requirements of the newer food and plant protectants if they are to find wide acceptance.

Low codling moth population in the Yakima, Wash., area made it difficult to show significant differences between various treatments, according to F. P. Dean, USDA entomologist. Guthion and Bayer 29493 plots showed no worms in 2,000 apples from each plot; Sevin, one wormy apple. Diazinon, Bayer 34098, and ethion were almost as good.

Essentially similar reports were made from California, Oregon and British Columbia.

Dean also reported excellent control of Mcdaniel mites with Kelthane and Tedion when two applications were made. Bayer 36205 was equal to them and the best of several Bayer products. Volck Supreme oil in two applications also gave very good control. European red mites have been scarce in the Yakima Valley for the past two years, Dean commented, so no tests in controlling them were conducted.

Excellent control of European red mites was obtained in the Hood River, Ore., area with Volck Supreme oil plus lime sulfur; Penco Superior oil, also plus lime sulfur; Volck Supreme oil, Ethion and Diaz-N-Oil, according to F. E. Ellertson.

Some fruit injury and partial defoliation of trees resulted from use of some of the Bayer compounds, reported Dr. Stanley Hoyt, Wenatchee, Washington State University tree fruit experiment station entomologist. Kelthane was good where resistance had not developed, and another experimental material, HOE 2784 was good, although its duration was not so long. Tedion in general also did a good job of controlling resistant strains.

Approximately 65 new materials were screened for control of two-spotted mites at the tree fruit experiment station, according to F. H. Harries, USDA entomologist stationed there. Among the most effective were some 15 different Bayer compounds; Stauffer's R-1448, R-1504, R-1505 and R-1571,

as well as Du Pont's 619, and Velsicol phosphate 100.

Actidione, a systemic which prevents reproduction in mites, controlled the two-spot, Mcdaniel and European red, he added. Derivatives of the compound appeared much less effective.

Outstanding control of European red mites in British Columbia was reported following use of Bayer 30886, applied either in concentrate or by high-volume airblast sprayers. Very slight foliage injury was noted where the high volume method was used, but none following application by concentrate sprayers.

Six different materials provided effective control of rust mites, Dr. Hoyt revealed in another report. These are Kelthane, Sulphenone, Bayer 30686 and 36205, HOE 2784, and Sevin.

One-to-one dilutions of Rogor, containing 30% dimethoate, gave perfect control of apple aphids in British Columbia when it was painted on the lower trunks of dwarf apple trees in July, August.

Excellent finish of Guthion-sprayed pears was reported by Dr. Louis Gentner, superintendent of the southern Oregon experiment station, Medford. Some fruit injury or drop was reported when some of the other codling moth controlling sprays were used. Ellertson declared that no worms or stings were found in 2,000 Anjou pears examined at harvest from each of several treatments, including two covers of Guthion, or two covers of Sevin, or four applications of Diazinon.

Variations in the resistance of pear psylla to parathion make evaluation of many of the new materials on a state-wide basis difficult, Dr. Everett C. Burts has concluded. He is an entomologist at the tree fruit experiment station in Wenatchee. Most effective materials for controlling psylla at cluster bud time are Sevin, Dilan and Guthion.

Foliage screening tests revealed that several Bayer compounds as well as Dimethoate, Phosphamidon and HOE 2784 showed promise, with Dilan and Guthion comparable with the best of the new materials. The two components of Dilan, prolan and bulan, were equally effective, he added. Dean added that control of psylla was not particularly difficult this year, with Guthion and Dilan providing almost perfect control. Bayer 36205 was almost as effective as Guthion.

Psylla in southern Oregon have developed resistance to all organic phosphate materials except Guthion, according to Dr. Gentner. Dieldrin and Thiodan gave excellent control, and toxaphene also was good, but control with Sevin was only fair.

Sevin was the most effective material in controlling codling moths in walnuts, M. M. Barnes of the citrus experiment station, Riverside, Calif., reported, while Thiodan was excellent in holding down populations of the walnut aphid.

Apple powdery mildew was the worst during 1960 that it has ever been during the years he has worked in central Washington, Dr. Roderick Sprague, plant pathologist at the tree fruit experiment station, declared. Five sprays of Karathane were required to hold it in check.

Niagara 5943, with the same number of applications provided about equal control. Naugatuck O6K arrived late, so needs further testing, as does DY-Q-Plex-1, which Dr. Sprague classified as an apparently safe colloidal copper hydroxide.

Complete control of apple scab in British Columbia resulted from four applications of Cyprex applied by concentrate sprayer in spite of the fact that weather conditions favored the disease development. This was the report of D. L. McIntosh and J. E. Swales, respectively plant pathology section, research station, Summerland, and district horticulturist, Creston.

Outstanding control of prune brown rot was achieved with Maneb when it was applied in three sprays at the popcorn, full bloom, and petal fall stages, according to Dr. Iain C. MacSwan, Oregon State college extension plant pathology specialist. He expressed the belief that an effect beyond disease control was being achieved.

E. W. "Ted" Anthon, entomologist at the tree fruit experiment station, Wenatchee, will be chairman at the next spray conference, set for Jan. 17, 18, and 19, 1962.

M. M. Barnes, University of California citrus experiment station, Riverside, was chosen as chairman-elect to succeed Anthon next year. Anton S. "Tony" Horn, Idaho state extension horticulturist, Boise, was re-elected secreary-treasurer.

Insect Conference

The 21st annual Pacific Northwest Vegetable Insect conference will be held Jan. 15, 16, and 17 next year. A session of scientists particularly interested in control of virus diseases in plants probably will be held in connection

Convening in Portland, Oregon, during the week were the 20th annual Pacific Northwest Vegetable Insect Conference, the Western Cooperative Spray Project, and the 8th annual Western Agricultural Chemicals Association Northwest conference.

The appearance of the bronze cane borer in Utah last season is believed to be the first appearance west of the Mississippi River for this dangerous pest of raspberries. Up to 90 per cent of the canes are destroyed in a season by the borer, with the damage varying according to the raspberry variety attacked. Because large areas in the Pacific Northwest are devoted to raspberry production, the introduction of this pest could be serious.

with the various meetings as it has in the past.

Jack Holland, Portland, American Cyanamid, was chosen as conference chairman for the ninth annual Western Agricultural Chemicals association Northwest conference to be held in 1962 in conjunction with the 36th annual Western Spray conference. Holland, who was selected last year as the outstanding agricultural chemical salesman of the Pacific Northwest, succeeds L. E. Harris, also of Portland, Grange Cooperative Wholesale.

Chosen as "salesman of the year" from among 49 companies in the area was Hube Kenney, Yakima, Wash., Chemagro. Holland's election, and Kenney's presentation concluded the first of the two-day sessions of the industry representatives.

Jack Dreessen, Washington, D. C., representing the National Agricultural Chemicals association, earlier had urged them to improve their public relations by speaking before more clubs and other meetings. "We have a good story to tell," he commented, "let's get out and tell it more often."

Other speakers on the program had brought out the vital role of agricultural chemicals in feeding and protecting the health of the public.

Oregon State college has refused to recommend use of lindane on soil where root crops are to be grown because there is a strong possibility of off-flavors developing, Hugh Morrison, associate entomologist, explained in answer to a query when reports on the 20th annual Pacific Northwest Vegetable Insect conference were made to industry representatives.

When lindane had been applied at the rate of 1½ pounds per acre, taste panels were able to detect off-flavors in potatoes grown in the soil three years later, he reported.

Appearance of a new pest in the Salt Lake City area of Utah was reported by Donald W. Davis of the Utah Agricultural Experiment station. Known as the bronze cane borer, it is very similar to a pest of the Great Lakes region. Its appearance in Utah is believed the first reported west of the Mississippi. Up to 90% of the canes are destroyed in a season, with the damage varying according to the raspberry variety attacked.

Sometimes a planting is killed; in other varieties, the harvest for the year is lost. The pest could be very serious if introduced into the Pacific Northwest where large areas are devoted to raspberry production, it was pointed out.

Control of the bronze cane borer, also known as the rose stem girdler, is not difficult, according to Davis, if proper steps are taken at the right time. First is the matter of pruning out and burning infested canes before the insect emerges in the spring. The other step is to apply a spray before blossom period while the pests are in flight.

Based on limited trials, Dieldrin, Endrin, Thiodan and Sevin all produced good control; Dieldrin for two years. The others were tested during 1960 alone. None of the pesticides is registered for this use, but Davis reported that he believed some companies were applying for registration on the basis of tests made.

Because of the rapid growth of the agricultural chemical industry in the West, plans are being drawn to have the WACA represented on its board of directors by members from each of five regions, reported George H. Weldon, Berkeley, Calif., manager of Velsicol Chemical corporation's western division and WACA president. The districts would be Arizona, southern California, San Joaquin Valley, northern California, and Northwest.

A second vice president has been added to the officers to represent the Northwest and to be a liaison man between the WACA and the Northwest conference, Weldon continued. The new officer is Frank B. Stewart, Portland, Miller Products company, who had added duties at the conference this year. Because Charles O. Bernard, Sacramento, Calif., executive secretary, was in a hospital recuperating from an operation, Stewart assumed his duties at the meeting. It was the first session Bernard had missed.

Oregon's agricultural chemicals coordinating committee, which was praised highly by other speakers and is being copied elsewhere, was explained by Roy Miller, Portland, founder of Miller Products company, a prime mover in organizing the committee, and its present chairman. It was started in 1956 and is composed of representatives of industry, research personnel from Oregon State college and the extension staff. County agents, food processors and some of the college staff are invited to consult and advise with the committee.

Bringing and keeping pest control recommendations up to date are among its principal objectives. Also the committee is encouraging closer working relationship between industry and the college. Dr. Justus Ward, chief of the USDA pesticide division, ex-

(*Continued on Page* 91)

Annual ESA Meeting Part II

Training For County Agents

Training and refresher courses are necessary to keep county agents abreast of new control methods and recommendations

"SUPERFICIALLY, training programs are needed to keep county agents abreast of changes in recommendations, new uses for insecticides, other methods of control, and plain memory refreshing," remarked H. P. Petty, University of Illinois, at the annual meeting of the Entomological Society of America, held at the Haddon Hall Hotel, Atlantic City, N. J., November 28-December 1.

"Some states are faced with another problem," he added. "Formal schooling can be had and degrees in agriculture granted, without an entomology course having been taken. The same is true for plant pathology, weed identification and control, and perhaps in some cases in animal pathology. Some of these graduates become vo-ag teachers, assistant county agents, or youth assistants and soon become county agents, recognizing only grasshoppers. This situation began to take place 12 years ago in Illinois and we began to make preliminary plans for county agent training work at that time. I am sure Illinois is not unique in this position. We need a continuing basic entomology in-service training for county agents as well as current information training. We have incorporated ideas from many states and added our own ideas to them."

Problem: 180 county workers varying in education from no formal training to 7 college courses in entomology.

1. *Formal Field Clinics:* In the morning we discuss population trends and controls. In the afternoon we provide nets, killing vials, etc. and go to the field, dig, collect, count, and identify. As many as 2 such series in a year have been held.

2. *Informal Field Clinics:* Notify a county agent that we will visit his county; he notifies neighboring agents so they can be there. Also demonstrational test programs.

3. *Special State-wide Winter Insect Identification Schools:* We made a thorough 50 specimen collection of each species, including beneficial, incidental, and harmful insects, put them up in individual collections identified by number only. We prepare keys and other identification aids, invite in the 20 best county agent cooperators, presenting a 2 day school. Life cycles, damage, etc. are discussed.

4. *District Meetings of County Agents:* We have 8 such meetings, duplicating point #3 but condensing.

5. *June In-Service Training Conferences:* We can present a curriculum for a 4 day short course given for county workers. Thus far, we have not asked for time.

6. *Special Leaflets:* Life history, habits, control, etc., using Lehkers' Indiana plan.

7. *Weekly Bulletins:* Carried since the mid-forties with some revision. A warning system of what to be looking for and what to expect.

8. *Custom Sprayers' Training School:* A fast review and a bringing up-to-date session for anyone interested in agricultural chemicals. Our best year delivered 50 out of 180 possibles. Thus, county staff attendance is less than 7½% of the total—a poor showing.

9. *Condensed Recommendations.*

10. *Slide Loan Program.*

A. A. Muka, Cornell University, Ithaca, N. Y., remarked, "County extension workers in agriculture are a vital link in the communication chain between the research and extension specialist and farm people. The agent's training and capability, however, determine the quality of his work which in turn often determines the success or failure of extension programs. Thus an efficient system of training agents is very important for the future of extension in all phases of agriculture. The undergraduate training and in-service training programs for agricultural extension agents must keep pace with our rapidly changing scientific agriculture. The responsibilities for continuing to up-date training programs for these persons lies with the college administrators and specialists alike.

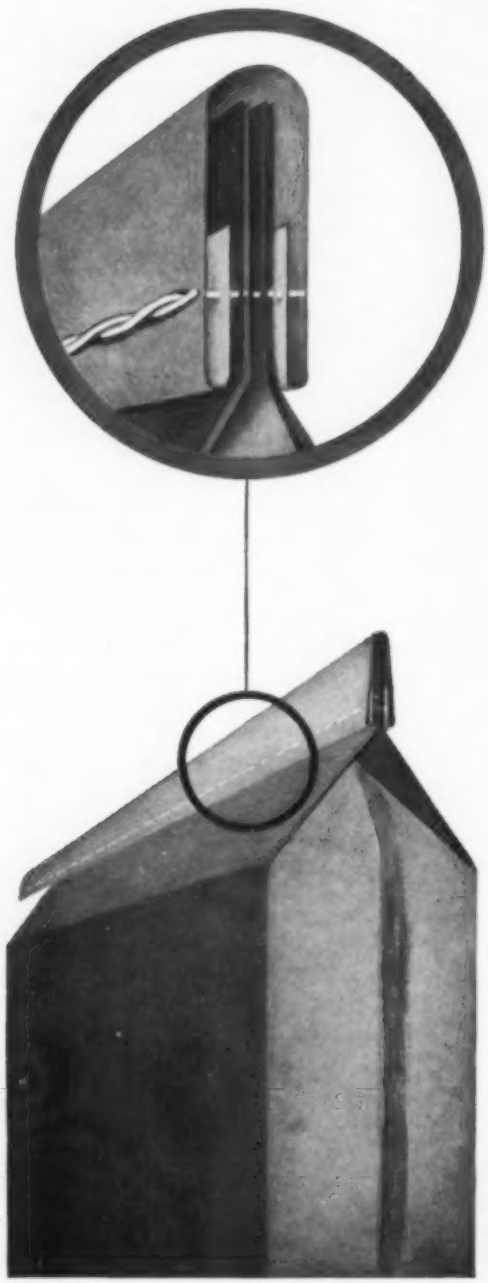
The programs in use or contemplated for New York Agricultural Agents include undergraduate training as well as in-service training. The undergraduate program is designed to give persons who desire to go into extension work a background in basic subject matter during the first two years and an opportunity to specialize later in either animal or plant science. In-service training programs provide for induction training, subject matter training for new agents and refresher training. The following include some of the types of training activities for agents; winter training schools at the college, summer field training in county groups, field tours, slide sets, and individual conferences. Agents are also taught the reasons why certain recommendations are made and brought up to date each fall on the next season's recommendations.★

PART III
of this report of the ESA meeting will appear in the March issue of **Agricultural Chemicals.**

ANOTHER TECHNICAL ADVANCE FROM WEST VIRGINIA

NEW ImpacTAPE™

DRASTICALLY REDUCES SEWN-END BAG FAILURE



Pioneer in the development of Clupak* extensible paper, West Virginia now leads the way to a far stronger, tighter, money-saving sewn multiwall through "ImpacTape."

ImpacTape is a revolutionary new type of sewn tape closure** that adds four layers of tape to the sewn end instead of the conventional two. This provides *49% greater toughness* than standard sewn 70-lb. tape closures plus a new "cushioning" against impact shock.

PROOF from actual field trial

A leading cement company had an unusually high sewn valve breakage rate of 1%. They packed a trial shipment of bags, using West Virginia's new ImpacTape. Average breakage rate went down to .3%—a reduction of 70%. Dollar savings from reduced breakage will far exceed the small upcharge for the new closure.

PROOF from new testing technique

The development of ImpacTape was hastened by West Virginia's successful adoption of the Impact Resistance Tester to measure sewn end toughness under conditions of sudden shock. It represents the only sewn closure test devised thus far which bears a predictable correlation to drop tests and actual field performance.

Studies indicate that 70% of sewn bag breakage ordinarily is at the sewn closure, even on Clupak paper bags, because the sewn closure is the weakest point in the bag. Often this breakage was incorrectly blamed on the paper. Now stronger ImpacTape opens the door to profits from the greater toughness and possible basis weight reductions which Clupak paper is delivering to thousands of users. *This is realistic research achievement —aimed straight at reducing your total packaging costs.*

For a brochure giving detailed information, write and tell us whether you use sewn open mouth or sewn valve bags. Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Ave., New York 17, N. Y.

**Clupak, Inc.'s trademark for extensible paper manufactured under its authority and satisfying its specifications.*

***Patent Pending.*

West Virginia Pulp and Paper

Pesticide Residues In Meat and Milk

When insecticides were fed to beef cattle and sheep as a contaminant of their feed, all except Methoxychlor were stored in the fat. Following spray treatments, all the chlorinated hydrocarbons, Co-Ral, and Malathion were excreted in the milk of dairy cows. Co-Ral appeared in very small amounts.

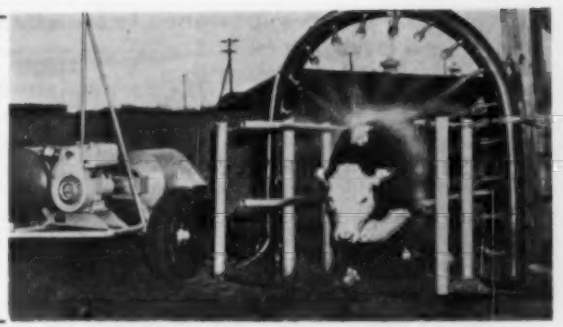


photo courtesy of Sprayfoil Corp., Minneapolis

THE U. S. Department of Agriculture's report of continuous research into the presence of pesticide residues in the meat and milk of cattle or sheep has been brought up to date with the issuance of ARS Bulletin 33-63 by the Agricultural Research Service, U. S. Department of Agriculture. The report was prepared by H. V. Claborn, Entomology Research Division; R. D. Radeleff, Animal Disease and Parasite Research Division; and R. C. Bushland, Entomology Research Division. It covers studies conducted at Kerrville, Texas, to determine whether insecticides used on livestock or on pasture and forage crops will contaminate meat or milk, and if residues are produced, how long they will persist.

Among the findings: Single spray treatments of DDT, TDE, and Methoxychlor, applied at 0.5 per cent concentrations to beef cattle caused storage of the insecticide in the fat. The Methoxychlor residues were eliminated in ten weeks, but DDT and TDE were detected in significant amounts 27 weeks after treatment.

The use of an 0.06 per cent Lindane emulsion spray on hogs resulted in residues in the fat of 0.66 ppm one week after spraying but none could be detected four weeks after the treatment. Residues of an 0.025 per cent suspension of Lindane dip in sheep and goats amounted to 4.22 ppm two weeks after dipping and could not be detected 12 weeks after dipping.

Lindane at a concentration of 0.03 per cent could not be detected, but at a concentration of 0.075 per cent, both sprays and dips caused residues in the fat. Multiple-spray treatments with Lindane and Methoxychlor at three-week intervals caused no greater storage in the fat than a single treatment.

In tests of the effects of multiple treatments of DDT, TDE, Methoxychlor, or Lindane, calves were sprayed six times at intervals of three weeks with one of the insecticides. These tests indicated that the storage of DDT and TDE following the second spray treatment was almost twice as great as that after the first treatment, but further spray treatments caused no significant increase. Residue figures for Methoxychlor were variable, but the highest figure was obtained following the sixth spraying. The results with DDT indicated that the storage of the insecticide in the fat reached a maximum after six applications. Multiple treatments at two- or three-week intervals with other chlorinated hydrocarbon insecticides – Chlordane, gamma Chlordane, Dieldrin, Heptachlor, Strobane, and Toxaphene – resulted in slight-to-moderate increases in the amount of storage. A 0.5 per cent Malathion spray applied at weekly intervals caused no storage in fat.

When insecticides were fed to beef cattle and sheep as a contaminant of their feed at dosages likely to occur as residues on forage crops, all except Methoxychlor were stored in the fat. Only small amounts of Aldrin were found even at the highest feeding level of 10 ppm. Most of the Aldrin was oxidized and stored as Dieldrin. The Dieldrin residues were slightly less in sheep than in steers. The residue in the fat of hogs was approximately one-half that in the steers.

Chlorine found in fat from the steers could practically all be accounted for by the Dieldrin and Aldrin present in the fat. Other chlorine metabolites of Aldrin

(Continued on Page 94)

HOW TO GET THE MOST FOR YOUR MACHINERY DOLLAR

Before You Buy, Check Sturtevant's Answers to These Key Questions

Q – How much experience is built into the design?

A – You get the benefit of 84 years of practical experience in each Sturtevant machine you buy. Unrivaled for fertilizer and insecticide plant engineering know-how, Sturtevant originated the 'Unit' idea. Whether your need is for a replacement pulverizer or mixer, or a completely modern granulating unit, Sturtevant-engineered machinery always can be depended upon to fit your requirements like a glove.

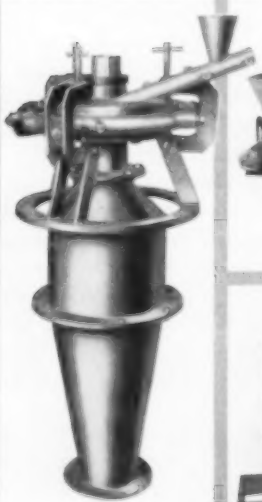
Q – Is the machinery engineered for peak-load efficiency?

A – All details in each Sturtevant machine have been proved by years of peak-load performance. Rugged construction that withstands the most slam-bang use, gears designed to always perform dependably, bearings that stand up under the heaviest loads, all can be taken for granted in Sturtevant machinery. Many Sturtevant machines have been operating at top capacity and efficiency for well over a quarter of a century.

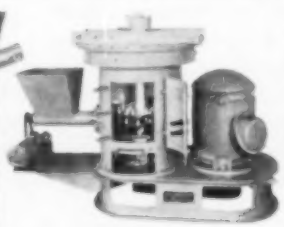
Q – How accessible is the machinery for clean-outs and repairs?

A – Clean-outs are a constantly recurring problem in the operation of fertilizer and insecticide plants. And minor repairs on hard-to-get-at machinery can consume hours of costly man and production time. Sturtevant's practical "Open-Door" design guarantees quick accessibility — for clean-outs and repairs. Any parts requiring cleaning or maintenance are quickly exposed by "One Man in One Minute."

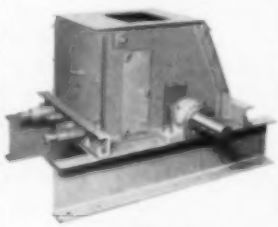
For rugged, reliable, efficient machinery you can depend upon for years — or for engineering assistance in planning or upgrading your unit — it will pay you to consult Sturtevant. Write to STURTEVANT MILL COMPANY, 123 Clayton Street, Boston 22, Mass.



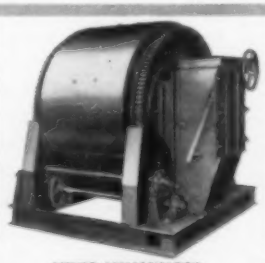
MICRONIZER



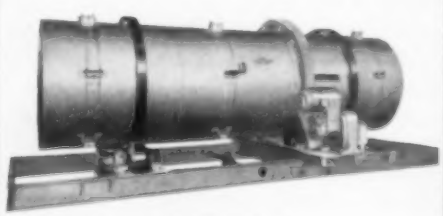
PULVER-MILL



ROTARY PULVERIZER



MIXER-AMMONIATOR



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COMPLETE INSECTICIDE PLANTS
COMPLETE GRANULATION PLANTS
MIXING AND SHIPPING UNITS
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FEEDERS and OTHER ACCESSORIES
AIR SEPARATORS
CRUSHERS AND GRINDERS

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Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

State Committees Report On Pesticides and Public

California's special committee finds that the food supply is safe and the public health is not threatened by use of agricultural chemicals. The Wisconsin subcommittee urges formation of a board of pesticide review to supervise regulations, licensing, and labeling of agricultural chemicals.

IF pesticides were not available, the people of the United States would have to accept insect-contaminated foods and be satisfied with less foods, said California's special committee on public policy regarding agricultural chemicals in its year-end report to Governor Edmund G. Brown. The committee added that many growers can report instances in which there would have been total loss of a crop without a pesticide control program.

The fifteen-member committee, appointed by Gov. Brown last year, met six times to study, review, and report on the subject. Among those on the committee were Dr. Emil M. Mrak, Professor of Food Technology, University of California, Davis; Louis A. Rozzoni, California Farm Bureau Federation, Berkeley; Dr. W. Elwyn Turner, Director of Public Health, County of Santa Clara Health Department, San Jose; Dr. Ralph C. Teall, California Medical Association, Sacramento; Dr. Malcolm H. Merrill, California State Department of Public Health; and William E. Warne, California State Department of Agriculture, Sacramento.

The report stated that the great preponderance of evidence heard by the committee convinced its members that "at this time our food supply is safe. The belief of some witnesses that the presence of *any* chemical residue in foods is deleterious was not substantiated. And, the public health is not threatened in this way."

Among the findings of the committee are: Agricultural chemicals are necessary to production of food and fiber crops in the quantities needed by the increasing number of people in the United States. Safeguards are essential and are now provided in the use of agricultural chemicals to insure protection from residues. All users of pesticides should be encouraged through a continuous campaign of education to follow directions explicitly. And, public concern should be allayed by informing consumers of protection they are receiving.

Data presented to the committee shows no evidence, it was stated, that any increase in morbidity or frequency of deaths from chronic diseases is related to the ingestion of agricultural chemicals in food. The committee added, however, that it recognizes the need for continuing research and enforced regulation to keep abreast of any change.

The most prevalent problems associated with agricultural chemicals, in the opinion of the committee, are accidental ingestion of agricultural chemicals by children, and contact with these substances by field workers during their application. In this regard, the committee recommended that adequate labeling and public information concerning the danger of such products should be a continuing effort.

In seeking information on the accumulaton of phytotoxic chemicals in the soil, the committee found that off-flavor problems occasionally have been reported in root crops, such as potatoes, grown in soils treated with BHC. In addition, carrots may pick up residues of chlorinated hydrocarbons where they have been applied repeatedly in heavy quantities to soil, the committee said. It was found, however,

(*Continued on Page* 93)

Wisconsin Group Advocates Pesticide Board

A SPECIAL subcommittee of the Pesticide Advisory Board appointed last January by Gov. Gaylord Nelson of Wisconsin has issued a report to Gov. Nelson recommending that a board of pesticide review should be appointed by the governor to determine policy for wildlife protection and evaluate pesticide problems as they arise. Recommendations about regulations, licensing, and labeling should be left to this board, the report said.

The report also recommended the appointment of a technical advisory committee for the board and a committee of educators to be responsible for a public education program.

"The general public," said the report, "has not been adequately informed about the needs, benefits, and hazards of pesticides. In many instances, it has become complacent to the real hazards involved, or, on the other hand, unnecessarily aroused by uninformed or biased leaders of public opinion."

The report was filed last month by a subcommittee on the relation of chemicals to forestry and wildlife, headed by Robert J. Dicke, professor of entomology at the University of Wisconsin. Other subcommittees have yet to report, including one on hazards to humans and one on chemicals and water supplies.

The Dicke report emphasized the effectiveness and value of chemicals to control plant and animal diseases, to produce farm and forest crops, and to protect and manage natural resources of both

(*Continued on Page* 93)

AG CHEM PRODUCTION ROUND TABLE

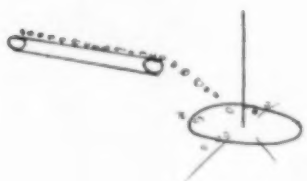
Avoiding Segregation of Fertilizers at the Storage Bin

THE problems presented by segregation of mixed fertilizers begin with the ingredients in the storage bins. Stratification at this point means increased variability in size classification among portions removed for successive blends, and consequently, some batches segregate rather seriously, whereas others prepared from the "same lots" of ingredients do not.

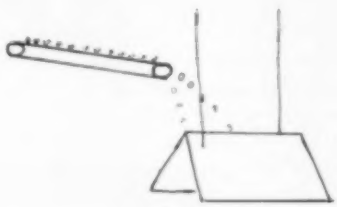
One kind of segregation occurs during pouring operations. Sorting of particles of different sizes and densities in mutually hindering fall through eddying air takes place in conformance with known rules. A different set of rules applies when the granules strike a conical pile. Plant operators have various means of minimizing this type of segregation.

One plant operator suggests suspending a circular metal disc by a chain over the storage bin, allowing the discharge stream to hit this disc and throw out all material without classifying (see illustration A below). In another case, it is suggested that an effective means of avoiding classification in pouring, is by suspending a "doghouse roof"-type unit under the discharge into the storage bin, —this would work in a way similar to the circular disc (see B).

Still a third bin filling method is to use a fast short conveyor belt directly after the unloading conveyor. The fast moving belt (about 12 inches wide, moving at about 800 ft/min) would throw both the fine and heavy particles fairly even.



(A)



(B)

Mills and Packers on Wheels

THE seasonal nature of the ag chemical business creates some real production problems for plant superintendents, and designers. How, for example, do you lay out a plant that will stand idle four or five months of the year—and then operate at one hundred and fifty percent of capacity during the peak of the season? A plant we visited recently had several answers that have proved efficient for them. A section of one mill that must be cleaned every few hours is mounted on wheels, and a replacement section similarly mounted is right along side. It is the matter of just a minute or two to uncouple, roll in the new section, connect it up and be back in production again before the dust has completely settled, while the disconnected section is wheeled away for cleaning.

They also mount their bag packers on wheels, and switch them, as needed, from one location to another around the plant, letting 8 or 10 units serve 15 or 20 packaging stations.

Sparger Material and Location

THERE are a number of ideas on where to locate a sparger in the mixer. Many production men admit that the most effective location is below the bed of materials, yet they will place the sparger above the bed, to allow it to last longer. The other question, concerning spargers is the material of construction. Black iron is, of course, the least expensive, but also the most susceptible to corrosion and needs to be replaced most frequently. Teflon and Hastalloy C are recognized as considerably less susceptible to corrosion, but also more expensive.

One technique involving spargers involves using a black iron pipe, drilling 3/8" holes, filling with teflon rod, then drilling the rod the prescribed sparger hole diameter. A certain amount of success has been realized with this technique, even though the interface iron-Teflon offers still another corrosion spot.

One plant manager indicates he prefers to use a black iron pipe

(Continued on Page 91)

Virginia-Carolina: "Michigans a big factor in reducing costs"

Time and time again it's performance that counts . . . and that's why the list of fertilizer manufacturers who own Michigan Tractor Shovels is long and impressive.

Virginia-Carolina Chemical Corporation is a good example.

One of their typical plants—at East St. Louis, Illinois—owns three Michigans. Their most recent report says the following . . . "Our Michigans (it reads) have turned in *major* cost-reducing, production-boosting performances!"

The story starts in 1956. That year, of the nine sizes of Michigans available, Virginia-Carolina chose the 16 cu ft Model 12B. Two of them were bought from Michigan distributor Bardale Equipment Co, St. Louis . . . the Michigan no-foot-clutch, power-shift transmission and fully-sealed all-Clark power train considered major benefits over existing equipment. The success of these machines led, as production demands increased, to purchase, in 1958, of the third Michigan Tractor Shovel.

When the above picture was taken, the three Michigans had compiled a total of 23,100 working hours. Outside of a minor steering column failure, they had lost virtually no assigned work time.

Their assignment included (and still includes) handling of all kinds of material—superphosphate, muriate of potash, ammonium sulphate, and others. On a typical job—taking material from boxcars to conveyor hopper—one machine usually will make

about 40 shuttle trips an hour. The complete unloading task takes about two hours. Units also handle binned material, feed the batch scale, etc, etc. Loads range from 880 to 2,000 pounds each.

Lifting *capacity*, incidentally, of these 12B Michigans is 3,000 pounds. A wide range of buckets are available, 9 to 27 cubic feet. For still greater capacity, there's a new machine—also with two-wheel-drive—the 1 yd (standard bucket) Model 55B. Also available are seven job-proved *four-wheel-drive* Michigans, ranging from the 1 yd Model 55A to the Model 375A which handles buckets up to 10 cu yd capacity. Your Michigan Distributor will be glad to demonstrate any of them. Ask him anytime—see for yourself why firms like Virginia-Carolina, Agrico, Armour, Swift, International Minerals, Olin Mathieson, Smith-Douglass all buy—and repeat buy—Michigan fleets.

AG CHEM

Fertilizer Views and News

by Vincent Sauchelli

Dr. Sauchelli is a Consultant to the Agricultural Chemicals Industry.

P_2O_5 Fixation: An Asset or Detriment?

"PHOSPHORUS has accumulated in many fruit and vegetable soils to a point where it may be omitted from the fertilizer mixture for years to come."

This statement, abstracted from a recent article on fertilizing crops written by a soil technologist, is quoted to illustrate the kind of thinking which prevails among many agronomists and soils men. It will serve as a text to what follows.

Two schools of thought may be found among agronomists: Those who favor fertilizing the crop; those who favor fertilizing the soil. There are also some who believe in fertilizing both the crop and soil.

The fertilize-the-soil concept aims at building up the level of fertility of the entire mass of soil to a depth of 8 to 10 inches. This is pretty much the prevailing practice in many of the European and Asian intensively-farmed countries. Market gardeners and truck farmers everywhere apply substantially more pounds of plant nutrients to their soils than are removed by the harvests. They believe that is the preferred or only way by which to produce maximum yields continuously. It is known that as a consequence of such heavy applications of fertilizer, the phosphorus level of large areas of such farms in the U. S. has more than doubled what it was when the first settlers farmed the land.

The same is true of the potassium level.

In fertilizing the crop the main idea is to apply all of the fertilizer along the row so as to have as much of that fertilizer as possible consumed the same year. Perhaps under certain conditions this method is justifiable, – such as in sandy soils, in areas of high rainfall or where fertilizers are just coming into use and the rate of application is low. The fertilize-the-soil concept prevails in many of the European countries, and in Japan where farmers apply the heaviest rate per acre in the world.

Now, how does fixation of phosphorus enter into the discussion? Soil chemists have found that when a phosphate fertilizer is applied to a soil (direct or mixed with other fertilizer materials) it reacts with iron, aluminum or other chemical elements present to form less water-soluble compounds. It reacts also with the clay-humus content of the soil. The process is described as "fixation." Phosphorus fixation is regarded by many as a terrible waste, a loss of an important resource. How justified is such an alarm?

Probably nothing in soil science has been investigated as much as this phenomenon of phosphorus fixation. From the very extensive literature, Dr. H. T. Rogers of the Alabama Polytechnic Institute discussing this subject,* has selected a few representative data. No one denies the fact that fixation occurs; it is the interpretation of the facts that causes differences of opinion. Among other items, the following were mentioned by Dr. Rogers:

Dr. G. W. Volk reported a test with cotton on the residual effects of superphosphate** in which 60 and 120 lbs. of P_2O_5 were applied to a high fixing soil annually from 1930 to 1934 and then discontinued; Another area received 60 lbs. P_2O_5 annually for 25 years. Cotton yields were doubled over the check no-phosphorus plot as late as 15 years after applications were discontinued.

In another study reported by Alabama agronomists, (*Soil Sci. Soc. Amer. Proc. 21*:618-620) 980 lbs. of P_2O_5 were applied over a period of 16 years to a Eutaw clay soil of high fixing capacity. Ladino clover was the crop grown. P_2O_5 applications were then discontinued. The check plot continued to receive superphosphate. The plots on which treatment was discontinued produced even after 4 years, 68% as much clover as did those plots receiving superphosphate continuously. These residual effects of superphosphate were studied in Alabama with other crops. The

(*Continued on Page* 93)

*"Agronomic Needs in Fertilizer Development" Jan. 22, 1958. Mimeograph

**"Response to Residual Phosphorus of Cotton in Continuous Culture." *J. A. Soc. Agron. 37*:330-340.

"...BY FAR THE FINEST AGRICULTURAL AIRCRAFT THAT HAS EVER BEEN PRESENTED..."

Richard P. Rice, owner of Bootheel Flying Service, Kennett, Missouri, reports: "Since I have the oldest continuous aerial agricultural operation in the state of Missouri (15 years of accident-free operation), I feel I am qualified to evaluate agricultural aircraft. I have used a number of types of aircraft and am at present using three Pawnees.

"Without reservation, I should like to say that the Pawnee is by far the finest agricultural aircraft that has ever been presented to the aerial applicating industry. Both my two pilots and I wish to express our thanks to Piper for pioneering the development of the first truly modern agricultural aircraft.

"As you say in you brochure, the Pawnee is truly the answer to an applicator's dream."

SAFEST, BEST, MOST PROFITABLE AGRICULTURAL PLANE YOU CAN BUY

Hundreds upon hundreds of Piper Pawnees in operation throughout the world—dusting and spraying crops and areas with all varieties of agricultural chemicals—have proved beyond question that the only airplane for safe, efficient, profitable dusting and spraying is an airplane specifically designed to do the job. Reports from Pawnee operators attest over and over again that this is a truly remarkable agricultural airplane. More than one pilot is still flying because the Pawnee's "safety capsule" cockpit protected him, exactly as planned and designed.

PIPER Pawnee

Regardless of your dusting or spraying requirements, your investment in a Pawnee or fleet of Pawnees will bring you a higher return per dollar than any other equipment you can buy.

If you want profits, pick the PAWNEE. NEW DEFERRED PAYMENT PURCHASE PLAN. See your Piper distributor or write for new 1961 Pawnee brochure, Dept. M-2.

WORLD'S LEADING BUILDER OF AGRICULTURAL AIRPLANES

PIPER

AIRCRAFT CORPORATION
LOCK HAVEN, PENNSYLVANIA

The Custom AG CHEM Applicator

Proper Calibration of Spraying Machines

Any variation in nozzle size, operating pressure, forward speed, or nozzle spacing can change the rate of application to the extent that poor pest control may be obtained or the crop may be damaged. Three methods may be used to determine the output of a sprayer in gallons per acre.

A SPRAYER must be calibrated properly so that the discharge rate is known. The size of the nozzle, operating pressure, forward speed, and nozzle spacing on the boom affect the volume that a sprayer will discharge. Variation in any of these factors may change the rate of application to the extent that poor pest control is obtained or that the crop is damaged.

Three methods may be used to determine the output of a sprayer in gallons per acre. The first method is by use of the nozzle manufacturer's tables which give gallons per acre subject to nozzle size, pressure, and forward speed. When the nozzle manufacturer's tables are used for determining sprayer output, however, the sprayer should be calibrated at least once each season by one of the remaining methods.

The second method of calibrating a sprayer is by operating it over a measured distance of 200 feet and calculating the amount discharged on a per-acre basis. Enough water should be put into the sprayer to fill the system, and the sprayer should be operated until the water is sprayed out uniformly. The pump then should be stopped and any water remaining in the tank should be drained out. Following this, a measured quantity of water should be put into the sprayer. The sprayer should be operated over the measured 200-foot run at the desired speed. Then, the remaining water should be drained and measured to determine how much water was sprayed out. The gallons-per-acre output can be calculated by multiplying the number of gallons sprayed per 200 feet by 217.8. The product of this should then be divided by the boom length or spray swath width. If, for example, 2¼ gallons are sprayed in a 200-foot run from a 30-foot boom (or from a side-swath nozzle on a boomless sprayer that covers a 30-foot swath), the number of gallons (2.25) should be multiplied by 217.8, which would equal 490. This, then, divided by 30, will result in 16.33, which is the number of gallons per acre.

The third method of calibrating a boom or boomless type sprayer is by operating it over a measured distance and calculating the amount discharged on a per acre basis. In this method, the length of the boom or spray swath width should be divided into 43,560. This will provide the number of feet the sprayer is required to travel to cover one acre. For example, if the boom length or swath width is 20 feet, then 20 divided into 43,560 will equal 2178, or the number of feet required to cover one acre.

The sprayer tank then should be filled full of water and the required number of feet (2178 in this case) should be sprayed at a speed which can be maintained in the field. The tank then should be refilled and the number of gallons required to fill the tank is the number of gallons that this particular sprayer is applying per acre. Then, for example, if the sprayer is discharging 25 gallons per acre and the spray program calls for one quart of chemical to be applied per acre, one quart of chemical should be added for each 25 gallons of water to be placed in the sprayer tank.★★

Care Of Sprayers Following Herbicide Use

The sprayer should be cleaned thoroughly after each spraying operation since many herbicides are corrosive, causing scale to form, in addition to damaging parts of the pump, pressure regulator and nozzles.

When 2,4-D esters or oil soluble materials have been used:

1. Rinse the sprayer system with kerosene.
2. Put in 1 to 2 pounds of washing soda to 30 gallons of water or 1 quart of household ammonia per 30 gallons of water.
3. Allow this to remain in the sprayer for several minutes. Then start the sprayer and circulate it through the system.
4. Drain the sprayer.
5. Rinse the sprayer again with water and drain.

When 2,4-D amines or other water soluble salts have been used:

1. Rinse the sprayer system with either 1 to 2 pounds of washing soda or 1 quart of household ammonia in 30 gallons of water. Allow the solution to stand in the sprayer for several minutes; start the pump and circulate it through the system. Then drain the sprayer.
2. Rinse the sprayer system with 6 to 8 ounces of liquid detergent in 30 gallons of water and drain.
3. Rinse the sprayer system with water and drain.

To prevent rust or corrosion, flush the sprayer system by pumping through it a solution of automobile radiator rust inhibitor in water (½ cup per gallon of water) and drain. Kerosene or fuel oil will not prevent rust or corrosion.

Information courtesy of E. M. Trew and John A. Long respectively, Extension Specialist, and Instructor, Department of Agronomy, Texas Agricultural Experiment Station, Texas A. & M. College System.

Flowable Sevin Formulation

Stauffer Chemical Co., New York, has developed a flowable formulation of Sevin insecticide that is instantly dispersible in spray machinery, including the low-agitation type units that often are used in airplanes.

Prior to this, Sevin had been available only as a wettable powder. The new Stauffer flowable formulation contains four pounds of Sevin per gallon. It is being marketed nationally by Stauffer.

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Multi-Purpose Sprayer

The Besler Corp., Oakland, Calif., is offering a multi-purpose sprayer that can be used to spread either granular or semi-liquid fertilizer, or other chemicals, at a rate of 200 acres per day, in addition to its use as an air carrier sprayer and duster. Literature on the machine, the "Turn A Spray," is available from the company at 4053 Harlan St., Emeryville, Oakland 8, Calif.

In Actual Flight Tests

Swathmaster Spreader Increases Ag-Cat Capacity

Transland Aircraft has developed a small version of its Swathmaster spreader for use with medium powered aircraft. It has proven successful in tests conducted by a California applicator using the Grumman Ag-Cat.

THE results of flight and job-performance tests at Bakersfield, California, last fall indicate that the small Swathmaster chemical dispenser can successfully be adapted for use with the Grumman Ag-Cat agricultural aircraft.

Actual work performance with the small Swathmaster revealed that the 220 hp Ag-Cat can handle 1,600 pounds payload while the 450 hp Ag-Cat can carry more than a 2,100 pound load. Manufactured by Transland Aircraft at Torrance, Calif., the small unit weighs approximately 87 pounds, about 30 pounds lighter than the larger and original Swathmaster.

Applicating rates effectively achieved during Swathmaster pattern distribution tests and on actual jobs indicate that dust materials, such as 5-75 DDT and sulfur, can be distributed to 50 foot swath widths at flow rates up to 50-60 pounds per acre. Liquids can be applied up to 80 gallons per acre, while normal flow rates ranging from one to ten gallons per acre produce 50 foot swaths.

With the Swathmaster wing panel trailing edges opened approximately one inch, fertilizer and seed materials were effectively distributed at a rate of up to 100 pounds per acre at swath widths from 40 to 50 feet. Flying at 30 foot altitude, Swathmaster-equipped Ag-Cats distributed rice and barley seed up to 100 pounds per acre with 42 to 50 foot swath widths for double coverage. Open wing trailing edges did not seem to affect the flow of dust or liquid materials.

A 450 hp Grumman Ag-Cat equipped with a small Swathmaster is shown in flight. The spreader also can be used with the 220 hp Grumman Ag-Cat and is being tested with other agricultural aircraft.

Joseph Lippert, manager of Grumman's agricultural aircraft project, reports that similar evaluation tests with the small Swathmaster are underway at the Ag-Cat factory in Elmira, N. Y., in an effort to determine the feasibility of offering the small Swathmaster as a factory-installed accessory.

Originally invented and developed for use with Boeing 75 Series Stearmans by Joseph Sellers of Bakersfield, Calif., the Swathmaster has successfully been adapted to a variety of single and multi-engine aircraft. For instance, on the U. S. Department of Agriculture's fire ant control program in the southern states, agricultural operators have been using North American B-25 modified bombers fitted with the larger Swathmaster to distribute insecticide granules.

The small Swathmaster is intended for use with medium powered aircraft, such as the 220 hp Stearman and N3N and the Ag-Cat. Under some applicating conditions, the small Swathmaster has been used with Piper's PA-18A's and Pawnees.

The Bakersfield, Calif., tests are being conducted by James French, French Aviation Co., Bakersfield, who is the U. S. western distributor for the Ag-Cat. He has tested the small Swathmaster with both the 220 hp and 450 hp Ag-Cats on actual application work. Also conducting tests with the small Swathmaster is the Snow Aeronautical Co., Olney, Texas, producer of 220 and 450 hp agricultural aircraft. Reports from New Zealand indicate that Swathmasters are being used with Fletcher FU-24's.★★

Illinois Association Discusses Winter Application

From the left: Dr. John Bigger, entomologist, Illinois Natural History Survey; Dr. Ralph Glasser, Shell Chemical Co., St. Louis; Bob Danforth, president, Illinois Association of Aerial Applicators; George W. Thomas, University of Missouri; and Dave Matthews, Purdue University.

A NEW method for applying Aldrin to cornfields during the winter months when the ground is frozen or covered with snow was covered at the fall meeting of the Illinois Aerial Applicators Association, Dec. 5, at Galesburg, Ill.

Dr. John Bigger, research entomologist for the Illinois Natural History Survey, said that, previously, Aldrin was applied at planting time or within a week before planting to control soil insects. Since this is the busiest time of the year for the farmer, he said, researchers at the University of Illinois attempted to find a more convenient time and more practical method for the farmer to apply the soil insecticide. For four years, Dr. Bigger continued, Aldrin was applied with fertilizers on corn fields with very good results. However, since soft ground often prevents the farmer from getting into the fields, he added, last year they attempted to apply Aldrin by air. The results of this experiment, he said, indicate that this method is as effective as the regular method.

Dr. Bigger pointed out that applying Aldrin in the winter months should be limited to fields that are reasonably flat. Liquid Aldrin may be applied when the temperature is above freezing, he told the group, and the granulated form may be applied at any time. Because this research was the only program of its kind carried on in the U. S., Dr. Bigger related, Illinois is the only state that recommends the application of soil insecticides during the winter months.

Bob Danforth, president of the Illinois Association of Aerial Applicators, said that the new method opens a new market for aerial applicators, and at a time when they could use the additional revenue, the winter months.

Other speakers at the meeting included Dr. H. B. Petty, extension entomologist, University of Illinois; Dr. Ralph Glasser, research chemist, Shell Chemical Co., St. Louis; and John Hawk, district manager for Shell Chemical Co.

International Aviation Conference Report Published

THE International Aviation Centre, The Hague, Netherlands, has published, in book form, the complete report of the first International Agricultural Aviation Conference, held September 15 to 18, 1959, at the Cranfield, England. (See page 72, November, 1959, issue of *Agricultural Chemicals*.)

The book contains the complete text of the approximately 50 papers presented at the conference. The text is in English and a summary in French follows each paper. Among the subjects covered in the 429-page book are; "Flight technique for fixed wing airplanes in agricultural aviation," "Safety aspects of aerial spraying," "Ground organization," "Fertilizer application," "Economic factors affecting the agricultural airplane manufacturer," "Corrosion," "Distribution equipment," "The physics of spray drift," and 'Requirements for an agricultural helicopter."

Illustrations and diagrams accompany many of the papers and complete transcripts of general discussions follow each of the 11 sessions into which the conference was divided. In addition, a complete listing of delegates to the conference is included.

Because the book deals with all aspects of the subject, it should be of value to aerial applicators as a manual for agricultural aviation. The clothbound book is available from the International Agricultural Aviation Centre, le v.d. Boschstraat 4, The Hague, Netherlands. Price is $7.

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Precision Spray Nozzles

A new line of precision spray nozzles is being offered by Associated Precision Industries, Chicago. The nozzles are available in a wide range of standard nozzles sizes in brass, monel, steel, stainless steel, hard rubber, and Teflon, and in a variety of spray patterns of hollow cone, hollow cone wide angle spray, solid cone, flat spray, extra wide angle spray, and adjustable flat spray. Complete information about the nozzles is available from the company at 6459 N. Sheridan Rd., Chicago 26.

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Arizona Group Meets

The 8th annual conference of the Arizona Aerial Applicators Association was held January 12 and 13 at the "Wigwam" in Litchfield Park, Arizona. The attendance was 160.

Among the speakers at the meeting were Robert E. Monroe, executive secretary of the National Aviation Trades Association, who reported on the "Washington Situation"; Russell Fishback of the Federal Aviation Agency, who reported on his experiences at the Ohio Ag Pilot School; and Tad Monroe, Tucson Airport Authority, who talked of applicator regulations.

AG CHEM LISTENING POST

by Paul Miller

This department, which reviews current plant disease problems, is a regular feature of AGRICULTURAL CHEMICALS. The comments are based on observations of collaborators of the Epidemiology Investigations, Crops Protection Research Branch, USDA, Beltsville, Md.

Use of Pimaricin In Isolation of Phytophthora SPP

J. W. Eckert and Peter H. Tsao (1), of the University of California, tried adding pimaricin to agar as a means of preventing growth of the secondary fungi that often hamper isolation of *Phytophthora* spp. and related fungi from root tissues. They found that addition of sodium pimaricin, plus sodium penicillin G and polymyxin B sulfate to control bacteria, to agar did not affect recovery of *Phytophthora* spp. and Pythium spp. from fibrous roots of citrus but almost completely suppressed the growth of contaminating fungi. The pimaricin-penicillin-polymyxin agar also gave promising results as a selective medium for isolating *Phytophthora cinnamomi* from avocado roots and *Phytophthora cryptogea* from alfalfa roots.

Effect of Soil Fungicides

According to Donald E. Munnecke and John Ferguson (2), of the University of California, various investigators have obtained conflicting results in studies on effectiveness of soil fungicides against soil-borne bacterial plant pathogens. Munnecke and Ferguson therefore planned greenhouse experiments to determine the effectiveness of fungicidal soil treatment and the dosages required for bacterial control under soil conditions similiar to those in California nurseries, and also to study effects of the treatments on the soil nitrogen cycle. The chemicals used in both control and soil nitrogen studies were sodium *N*-methyl dithiocarbamate dihydrate (SMDC), methyl bromide, and chloropicrin.

For the control tests, the test bacteria were *Agrobacterium tumefaciens*, cause of crown gall, and *Corynebacterium michiganese*, cause of tomato bacterial leaf spot of geranium. The probable lethal dose, as indicated by experimental results, required for control of each chemical was used as standard for comparing effectiveness of the treatments and reactions of the pathogens. Munnecke and Ferguson found that the three test bacteria reacted similarly to treatment with methyl bromide and chloropicrin, but differed in response to SMDC. The dose of SMDC required for *C. michiganese* was twice as much as for *X. pelargonii* and almost three times as much as for *A. tumefaciens*. Except for the amount of SMDC required to control *C. michiganese* and *X. pelargonii*, lethal doses were within range usually recommended to control soil-borne fungi and nematodes. The results indicated that soil fungicides would control bacterial as well as most fungus soil-borne pathogens, according to Munnecke and Ferguson. They recommended allowing crop residue to rot for several months before treatment with soil fungicides.

Results of the soil nitrogen studies were in agreement with those obtained by other investigators in that nitrifying organisms were affected more than ammonifiers. Munnecke and Ferguson found that treatment with chloropicrin, methyl bromide, or steam stopped nitrification, but that more ammonifiers survived in chemically treated than in steamed soil. Effects of SMDC varied according to dose: nitrification was not affected at 100 pounds per acre, it was partially inhibited at 200 ppa, and it was completely inhibited at 400 or 800 ppa.

Evaluating Fungicides

J. H. Reinhart (3), of Olin Mathieson Chemical Corporation, used Fusarium disease (*Fusarium oxysporum* f. *cucumerinum*) of cucumber in developing a simple technique for evaluating potential soil fungicides. The method involved comparison of plant stands in chemically-treated infested soil, untreated infested soil, and untreated sterile soil, under rigidly controlled temperature and moisture conditions. These data were used in a new method of calculation to obtain a numerical expression of effectiveness of the test chemical. According to Reinhart, the method provides highly reproducible results and is particularly valuable for screening a large number of chemicals with similar fungitoxic properties.★★

Literature Cited

(1) Eckert, J. W., and Peter H. Tsao. 1960. A preliminary report on the use of pimaricin in the isolation of Phytophthora spp. from root tissues. Plant Disease Reporter 44:660-661. August.

(2) Munnecke, Donald E., and John Ferguson. 1960. Effect of soil fungicides upon soil-borne pathogenic bacteria and soil nitrogen. Plant Disease Reporter 44:552-555. July.

(3) Reinhart, J. H. 1950. A method of evaluating fungicides in the soil under controlled conditions. Plant Disease Reporter 44:648-652. Aug.

AG CHEM PEST ROUNDUP

by Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Survey & Detection Operations, Plant Pest Control Division, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in U.S.D.A.'s pest surveys throughout the U. S.

European Corn Borer Counts Generally Higher

REPORTS from cooperating agricultural agencies in 19 states regarding surveys to determine the abundance and distribution of the European corn borer show fall counts of the insect to be higher than in 1959 in the majority of states reporting. The information is obtained by determining the number of larvae found hibernating in corn stalks during the fall period, when the highest percent of mature larvae is present. Results are reported as the number of borers per 100 stalks or plants.

In the Central States, increases were most notable in Iowa, Wisconsin, Minnesota, and North and South Dakota. Counts in the district composed of Cass and Richland Counties, North Dakota, were the highest ever recorded for that district, being 474 borers compared with 125 in 1959. The overall average for North Dakota in 1960 was 372. It was 125 in 1959. South Dakota showed an increase in all districts with the average being 172 in 1960 and 51 in 1959. The highest counts were in the southeastern and east central districts, being 220 and 261, respectively.

European corn borers, in the 1960 Minnesota fall survey based on district counts, averaged 107, compared with 35 the previous year. The most notable increase in the State was in the west central and southwest districts. Counts were 173 and 280, respectively. In Wisconsin, the greatest increases were in the west central district with 120, central district with 215, and south central district with 135. The Wisconsin state average was 83, compared with 32 in 1959.

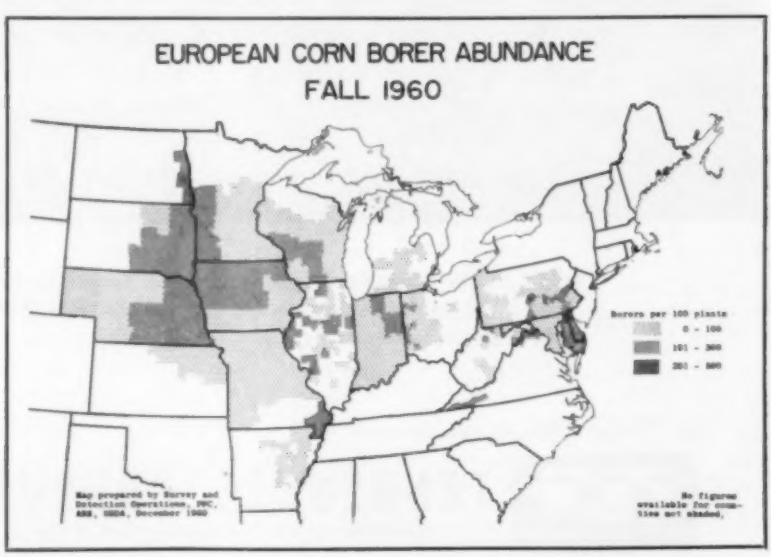
In Iowa the corn borer average increased from 50 in 1959 to 124 in 1960. The highest district count in Iowa was in the west central part of the State, District VII, where the count was 286 borers per 100 plants, compared with 30 in 1959. The second highest average, 235, for the State was in the extreme northwestern district. In Missouri, the greatest increase recorded was in the southeastern area where counts averaged 150 borers compared with 42 in 1959. State average for Missouri was 61, compared with 36 in 1959.

Illinois counts averaged 101, compared with 77 the preceding year. The highest count recorded was 211 in Ogle County, while Bureau County had 208 and De Kalb 200. Counts in northeast Kansas increased from 72 in 1959 to 77 in 1960. In Nebraska, the increase was from 116 to 119 and in Michigan from 11 to 27.

Ohio and Indiana were the only North Central states recording decreases, even though slight. Ohio reported 73 corn borers per 100 stalks in 1959 and 72 in 1960, while Indiana was down from 65 to 61.

In the Eastern States, comparable populations were higher than those in 1959 in Maryland, Pennsylvania, and West Virginia; being 136, 88, and 58, respectively, in 1960, compared with 114, 54, and 52 in 1959. Virginia had a count of 216 in 1960 and 182 the pre-

(Continued on Page 94)



VELSICOL

INSECTICIDE OUTLOOK for 1961:

plans, promotions, and favorable trends indicate
expanded sales opportunities for formulators!

HEPTACHLOR

...growing demand!

Extensive tests conducted by leading experiment stations prove that Heptachlor can't be beat for effectiveness in control of soil insects. Demand for Heptachlor continues to grow. In 1961, you will see more intensive advertising to capture even more sales. Besides major regional and state media, Heptachlor will be promoted in hundreds of local newspapers and billboards.

ENDRIN

...branching out!

Endrin is relatively new, in terms of uses and acceptance. 1960 saw the development of many new Endrin markets. Apples, potatoes, cotton and many other crops were widely treated with Endrin during the past year. The use of Endrin-Methyl Parathion mixtures for cotton insect control proved especially popular and effective. In 1961, you can anticipate a big Endrin demand in all markets, helped along by strong promotional programs keyed to local requirements.

CHLORDANE

...better than ever!

If they held popularity contests for insecticides, Chlordane would win the gold cup every year. Lawn and garden use has risen sharply as Chlordane has become established in crabgrass control. Chlordane is preferred because of its unmatched safety and performance record. 1961 promotional plans call for greatly increased local advertising, more national advertising, sales promotion and educational materials, and many other innovations.

WATCH FOR MORE DETAILS ON VELSICOL INSECTICIDE SALES SUPPORT PROGRAMS!

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In order to better serve our far-flung customers in the process industries, we have developed at Beaumont, Texas the most modern Sulphur storage, handling and loading facilities in the world. This terminal and shipping center is now receiving deliveries from all four major TGS properties in Texas: Spindletop, Moss Bluff, Newgulf, and Fannett - the most recent mine to be developed.

. . . . *is now operating at* **Beaumont, Texas**

THE WORLD'S NEWEST SULPHUR TERMINAL

. . . for Solid Sulphur

. . . for Molten Sulphur

A few of the design features of this terminal may be of interest:

- **It receives, stores, and loads both solid and molten sulphur.**
- **It can load simultaneously 1 dry cargo ship of 20,000 tons capacity, 3 molten sulphur barges and 1 molten sulphur tanker. There's a holding dock where a second cargo ship can be tied up. The barge basin will accommodate 12 sulphur barges.**
- **Storage capacity totals 31,000 tons for molten sulphur and 1,000,000 tons for solid sulphur. Loading capacity for molten sulphur ranges up to 3,000 tons/hour, tanker and barge simultaneously; for solid sulphur the loading capacity is 1,200 tons/hour into ship or barge.**

This development at Beaumont is but another step in the broadening delivery service program now being carried out by TGS. Regional distribution centers, handling molten sulphur, are already in operation at Cincinnati, St. Louis and Tampa. Coinciding with the full operation of our main terminal at Beaumont will be the opening early in 1961 of two coastal terminals at Carteret, New Jersey, (26,000 tons molten sulphur storage) and Norfolk, Virginia (20,000 tons). Other terminals are in the planning stage.

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AG CHEM

Washington Report

by Donald Lerch

WASHINGTON – always a big rumor factory – is an even bigger producer of speculation today. Nearly everyone is looking for changes in agriculture. The question is how will the trend go? How will the agricultural chemicals producers be affected?

One fact is important – it is that laws now on the books will hold good for crops going into the ground this spring. There is danger that too much talk of marketing controls, compensatory payments, and so on in the next few months may affect farmers' decisions to buy or not to buy agricultural chemicals. You can assure farmers that whatever changes we have will not affect most 1961 crops.

Rumors are flying though on the big questions–how to end surpluses and how to boost farmers' farm income. We have learned that top-level Democrats are talking about marketing controls and compensatory payments to gain these objectives.

While the new Secretary of Agriculture, Orville L. Freeman, was Governor of Minnesota, he had a survey of Minnesota agriculture conducted. The man who did it, we understand, was Willard Cochrane, University of Minnesota farm economist, a strong advocate of marketing controls. This would mean that farmers would get quotas for how many bushels of crops or how many pounds of meat or poultry they could sell. Specific quotas would be set by a referendum of farmers. Obviously, such a program would have a significant impact upon all marketing programs of agricultural chemicals manufacturers. Industry leaders here figure they would have to sharpen their economic sales story to show farmers how agricultural chemicals increase net income regardless of output as one way to cope with this possible development.

Another plan now being discussed at the top levels of the new Administration is one of compensatory payments to farmers in exchange for rigid acreage controls. This is the old Brannan plan, and surprisingly, a growing number of farm leaders appear to be swinging their support behind this concept. For one thing, they say it would help to reduce surpluses on one hand, and boost farmers' income on the other without boosting the cost of food to the American housewife. In the end, they say, it might even cost less than current Federal payments for buying and storing surplus crops.

Of course, many actions which are discussed most throughly in Washington never see the light of day. Because of a general groundswell of support for increasing farm income, you can hazard the guess that some form of the old Brannan plan will be enacted into law by the 87th Congress.

Washington Contacts

More and more companies are sending their own men to Washington and some firms are arranging to have Washington representation through public relations, marketing, or legal groups which already have established contacts with Congress, key government departments, and farm groups headquartered here.

Such moves – long contemplated by some companies – are being taken now in view of the expected growing impact of government actions on all kinds of businesses. The thinking is that the firms with on-the-scene representation will be the first to know of new government moves, will be the first to benefit from them.

There is no indication that rising government activity will be a disadvantage to businessmen. The new Administration's aim is to move the economy ahead faster – agricultural chemicals firms should move ahead with it.

In The Spotlight

The real spotlight will be on two men: Secretary of Agriculture Orville L. Freeman and Secretary of Health, Education and Welfare Abraham Ribicoff. These two men share responsibility for determining the use of pest control chemicals in food production. Furthermore, HEW has a controlling say in the use of pesticides in public health.

No one knows at this point how the new Secretaries will act toward chemicals. We have discovered, however, that both men as Governors of their respective states have shown a sincere interest in agriculture. Their urban experience gives them the background for adjusting any apparent conflicts of interest between farmers and urban consumers to benefit both groups and to hurt neither.

New Market

Pesticide manufacturers can look forward to the opening of a

(*Continued on Page* 92)

Arcadian® News

Volume 6 | Nitrogen Division, Allied Chemical Corporation | Number 2

Precautions for Handling Solutions in Cold Weather

Nitrogen Solutions with a high content of ammonium nitrate or urea salts are an economical source of nitrogen for production of high-nitrogen mixed fertilizers. But, certain precautions are required in handling these Solutions during cold weather, due to their tendency to "salt out."

Because of the high level of dissolved salts in these Solutions, their "salting-out" temperature is higher than that of Solutions containing more free ammonia or water. It is also higher than atmospheric temperatures during winter months in some areas.

The "salting-out" temperatures for all ARCADIAN® Nitrogen Solutions are shown in the specification chart on another page of the ARCADIAN News.

These are the Solutions' temperatures at which crystals begin to form. Crystallization of nitrogen salts does not start until the temperature of the Solution actually reaches the "salting-out" or "saturation" point.

Accurate Laboratory Tests

The exact "salting-out" point of each Solution is determined in the Nitrogen Division laboratory by gradually cooling the Solution until crystals start to form. "Salted-out" samples are then warmed and dissolution points of crystals are checked against previously-determined "salting-out" temperatures, to avoid any possibility of inaccuracy due to super cooling.

Nitrogen Division technicians chill the Solution until crystals occupy much of the visible Solution space. The Solution is then warmed and its temperature at the disappearance of the last crystal is determined. The test is then repeated with very slow warming as the indicated dissolution temperature is approached.

When the "salting-out" temperature is obtained by this method, there is no possibility of salt deposition above this temperature. Slightly below this temperature, only incipient crystal formation is possible. Crystallization increases progressively as the temperature is lowered further and only at much lower temperatures will the Solution freeze solid.

Temperatures Change Slowly

Solution temperatures actually respond very slowly to changes in atmospheric temperature. Tank-car quantities of Solution must be exposed to low atmospheric temperatures for considerable periods of time before the Solution temperature will drop to atmospheric temperature.

The amount of solids that crystallize are in proportion to the temperature drop below the saturation point, and crystals dropping out of solution lower the "salting-out" point of the remaining liquid.

Openings in spray pipes and lines in the fertilizer plant are usually of sufficient size to enable Solutions carrying small amounts of crystals to flow without difficulty.

The table shows the amount of salt which will separate from two NITRANA® Solutions at various temperatures below the "salting-out" point.

In practice, Solutions are often successfully handled and tank cars are completely unloaded, when atmospheric temperatures are considerably below "salting-out" temperatures. In such cases, it is important to avoid allowing Solutions to remain stagnant in pipe lines and equipment for a prolonged period. If there is to be a delay in operation, the system should be purged immediately.

Safety First!

Explosions or fires can be caused by applying heat with flame or electricity to

(continued on following page)

APPROXIMATE POUNDS OF SOLID SALT FROM 100 POUNDS SOLUTION WHEN COOLED BELOW THE SOLUTION "SALTING-OUT" TEMPERATURE

SOLUTION	"SALTING-OUT" TEMPERATURE	DEGREES BELOW "SALTING-OUT" POINT 5°F	10°F	15°F	20°F
NITRANA 4	56°F	2 lbs.	6 lbs.	8 lbs.	10 lbs.
NITRANA 4M	61°F	2 lbs.	5 lbs.	7 lbs.	9 lbs.

(continued from preceding page)

equipment which contains nitrogen solutions or even very small amounts of residue from nitrogen solutions. If you need heat to free piping of "salted-out" blockage, the safest heat to use is hot water or low-pressure steam.

Some operators heat the compressed air that is used to move nitrogen solutions, with the belief that this will conserve heat in the storage tank. This practice is ineffective and dangerous. The air carries very little heat and most of this is lost in the small pipe line. When high heat first contacts ammonia in the presence of air, there is always the danger of an explosion. Very hot air can cause an explosion in the pipe line, in the tank and even in the air compressor.

During cold weather, ARCADIAN Nitrogen Solutions arrive at your plant in well-insulated tank cars which usually stay warm until you have used the contents, when a few simple cold weather practices are utilized. This may involve working overtime to empty the car so that it will not lose heat overnight or over the weekend. Insulating the solutions pipe line is a tremendous help in cold weather handling.

Ten Helpful Suggestions

The following suggestions will assist you in more efficient handling of NITRANA®, URANA®, and U-A-S® Solutions during cold weather:

1. When atmospheric temperatures are expected to be below "salting-out" point, do not transfer solution to storage tanks but use directly from tank car. Ammoniating Solutions are loaded hot and Nitrogen Division tank cars are well insulated.

2. Insulate pipe lines wherever practical. Use the best insulation obtainable–but even dry burlap is better than no insulation.

3. When supply pipes are cold, do not introduce solution until mixing machinery has been started and the first charge of fertilizer is actually in the mixer. Then try to keep solution moving with a minimum of delay between charges. If for any reason delay is anticipated, blow the solution out of the measuring tank and out of pipe lines. Equipment should be arranged for blowing the solution back into the tank car or the storage tank.

4. After mixing operations have stopped and lines are cleared of solution, disconnect feed lines at tank car. This will avoid the filling of the piping through any leak in the shut-off valve.

5. Keep gauge glasses and gauge glass connections warm with electric heating devices or with electric lights. Infra lamps prove quite effective.

6. It is advisable to have gauge glasses and connections of at least ¾-inch size.

7. Use shortest feed lines practicable. Eliminate unnecessary bends and constrictions. Install enough union-connections for convenient dismantling of lines for cleaning. Install tees or crosses instead of ells at bends to permit cleaning with rods or stiff wires. The branches of tees should be upward. There should be no sags or dips in the line. Provide for complete drainage.

8. Unless necessary, do not vent air from tank car until unloading is completed, since this is a cooling action.

9. Equip solution lines with water connection for cleaning. If warm water is available, use this for cleaning and also to warm up feed lines and tank car valves before introducing solution. Completely plugged lines should be opened sufficiently by rodding to permit some water to be forced through in order to speed solution of the salt.

10. Avoid leaving small amounts of nitrogen solutions in the tank car overnight. A little overtime work may help you avoid a lot of trouble.

Advantages of Bulk Fertilizers

The practice of selling bulk fertilizers to farmers is rapidly gaining in popularity. This method of handling automatically favors heavier application per acre and greater total sales. And the larger farmers who are the best fertilizer customers often prefer the bulk system for a large part of their tonnage. Where bulk service is good, many farmers use it even where the products offered in bulk are inferior to those offered in bags.

Save Time and Labor

Handling fertilizers in bulk provides definite savings in time and labor for farmer, dealer and manufacturer. Where bulk fertilizers are handled mechanically, farmers are less apt to scrimp on recommended application rates per acre.

Many bulk truck and trailer units now on the market do an excellent job of spreading fertilizer for plow-down or top-dressing. Self-unloading feed and grain wagons are being designed for the additional job of handling fertilizer. Portable bins, hauled on trucks or wagons, are being used for fertilizer as well as for crops. New fertilizer broadcasting equipment is being designed with larger hoppers, and many farmers and dealers are also improvising bulk fertilizer equipment. New planters and drills come equipped with bigger hoppers located for convenient filling from bulk as well as from bags. Hauling equipment is also being adapted for easy mechanical unloading into fertilizer hoppers on planters.

The large investment needed for specialized bulk equipment helps to discourage the part-time dealer and the in-and-out price opportunist. Dealers who have invested in fertilizer-handling equipment must concentrate on doing a better job of merchandising to protect this investment. They are more inclined to stay active every year, to develop stronger and more stable markets. The natural result is a stronger distribution system built around better service.

The need for custom application of much of the bulk fertilizer tonnage is no real handicap to bigger sales. Efficient, large-scale custom equipment enables good operators to apply fertilizer at low cost per ton. The farmer is often happy to be relieved of the job. Many a custom operator finds that his close contact with the farmer helps him do a better all-around job of sales and service.

Arcadian News for Fertilizer Manufacturers from Nitrogen Division, Allied Chemical

Flow Meters for Ammonia

To measure ammonia accurately, and to assure trouble-free operation when you use ammonia, a flow meter has to be properly designed for this specific job. Liquid ammonia is anhydrous (water-free) ammonia held at a temperature and pressure that make it a liquid instead of a gas. At 70°F, it takes 114 pounds pressure per square inch (at gauge) to keep ammonia in liquid state from boiling.

Four Major Problems

Ammonia has four characteristics that often cause trouble in flow measurement. They must all be considered in design and installation of a practical flow meter for anhydrous ammonia:

1. Ammonia has very poor, almost no, lubricating quality.
2. Ammonia is extremely corrosive to copper and its alloys such as brass.
3. The pressure of ammonia must be kept above saturation value at any given temperature of the liquid—or—the temperature must be below the saturation value at any given existing pressure.
4. Ammonia has very low, practically no electrical conductivity which makes it impractical to measure through a magnetic flow meter.

The poor lubricating value of anhydrous ammonia makes a positive displacement type meter a poor choice. Even when made of corrosion-resistant materials, the moving parts of such a meter that are in contact wear rapidly. This quickly reduces accuracy of measurement. Displacement type meters usually allow a great loss of pressure which causes flashing of the ammonia.

The velocity type flow meters with a rotating cage may show undesirable wear of the bearings, but they have low pressure loss and excellent accuracy of measurement. One design on the market has sealed bearings to reduce wear.

The old stand-by, the orifice meter, has fair to good accuracy, depending on the quality of the installation and on the differential measuring device used. Pressure loss in this kind of meter can be minimized by proper orifice and pipe design and by use of a special low differential pneumatic transmitter.

On the score of flow meter accuracy, a measurement variation of ¼ per cent or less from actual flow is considered excellent, ¼ to ½ per cent variation is very good, ½ to 1 per cent good, and 1 to 2 per cent is fair.

The biggest problem in anhydrous ammonia flow measurement is in the temperature-pressure relationship. If the natural pressure of the anhydrous ammonia is used to move it, you get partial vaporization of the liquid at each point where (1) the temperature is raised slightly, or (2) the pressure is reduced slightly, or both. The bubbles formed by the vapor disperse through the liquid, and the increased volume is measured by the meter as liquid moved. For example, a flow meter reading may show 1,000 gallons of anhydrous ammonia moved when you actually had 900 gallons of anhydrous ammonia plus 100 gallons of vapor bubbles.

One satisfactory system of measurement for ammonia has a turbine meter in a system where the ammonia is pressurized by an inert gas to a higher level than the saturation pressure of the ammonia for a temperature at which the ammonia stays liquid. In another plant, the liquid ammonia is cooled below the temperature that is normal at the actual pressure of the ammonia.

Any flow meters of suitable non-corrosive materials, designed to handle a non-lubricating fluid, can be used for liquid anhydrous ammonia if the pressure is kept above saturation value, or if the temperature is kept below saturation value.

Temperature-Pressure

Use this table as a guide to maintain temperature and pressure of liquid ammonia at the proper relationship for accurate flow metering. Remember that at low temperature, the vapor pressure of anhydrous ammonia is low. At zero degrees, its vapor pressure is less than 16 pounds per square inch.

Temperature in Degrees F.	Pressure in Pounds per Square Inch
0	15.7
20	33.5
40	58.6
60	92.9
80	138.3
100	197.2

To add pressure: Find the saturation pressure of the ammonia at the flowing temperature. Add the maximum expected amount of pressure loss through the meter, then add an additional 20 pounds per square inch pressure.

To reduce temperature: Find the saturation temperature at the flowing pressure. Subtract enough degrees temperature to equal the expected loss through the meter and also subtract an additional 10°F.

READY TO ROLL. In addition to operating the largest fleet of tank cars in the industry, Nitrogen Division, Allied Chemical Corporation, has geared all of its facilities and operations to rapid delivery of ARCADIAN Nitrogen Solutions to help you meet production schedules. The goal is *on-time* shipment every day.

Arcadian® NITROGEN SOLUTIONS

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
DURANA®									
DURANA contains 8% formaldehyde.	37.0	13.3	53.4	15.9	9.4	7.2	1.235	0	36
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
Anhydrous Ammonia	82.2	99.9	—	—	—	24.3	0.618	211	-108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

NITROGEN DIVISION

MAIN OFFICE: 40 RECTOR ST., NEW YORK 6, N. Y., PHONE HANOVER 2-7300

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Omaha 7, Neb., P. O. Box 166 ..... 29 1-1464
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Atlanta 3, Ga., 127 Peachtree St., N. E. Jackson 2-7805
Memphis 9, Tenn., 1929-B South 3rd St. Whitehall 8-2692
Indianapolis 20, Ind., 6060 College Ave. Clifford 5-5443
San Francisco 4, Cal., 235 Montgomery St. Yukon 2-6840

NEWS ABOUT THE AG CHEM TRADE

Fertilizer and Lime Conference

A Fertilizer and Lime Conference will be held February 8 to 10 at the Nittany Lion Inn, Pennsylvania State University, State College, Pa. The conference is being sponsored by Penn State and the Pennsylvania Plant Food Educational Society.

Among the speakers will be Rodger C. Smith, Eastern States Farmers Exchange; Francis A. Raymaley, American Cyanamid Co.; Murray C. McJunkin, United States Steel Corp.; and W. H. Garman, National Plant Food Institute.

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Hercules Begins Operations

Hercules Powder Co., Wilmington, Del., has started operations of an expansion program at Hercules, California. The expansion includes new manufacturing facilities for the production of methanol, formaldehyde, urea-formaldehyde concentrates, and slow nitrogen release urea-form for fertilizer applications.

The newly-completed program provides facilities for the production of 11,000 tons of urea-formaldehyde compositions per year.

•

Armour Acquires Ris-Van

Armour Agricultural Chemical Co., a division of Armour and Company, has acquired Ris-Van, Inc., Belmond, Iowa, one of the corn belt's leading producers of liquid mixed fertilizers. Ris-Van had been a wholly-owned subsidiary of Stepan Chemical Co., Chicago.

The Ris-Van plants are located at Belmond, West Union, Sanborn, Vinton, and Jefferson, Iowa, and at Blue Earth and Wellmar, Minnesota. Ris-Van will continue under its present name as a division of Armour.

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FMC Advances Rodda, Kerbey

John Rodda

George Kerbey

John A. Rodda, manager, Fairfield Chemicals Department, Niagara Chemical Division, Food Machinery and Chemical Corp., has been appointed assistant to the president of FMC and will direct the activities of the corporation's Washington, D. C., office. He succeeds Hubert E. Dobson, who has been transferred to another assignment within the corporation.

George Kerbey, formerly Fairfield Chemicals' sales manager, has been named to succeed Mr. Rodda as manager of the Fairfield Chemicals Department. He has been associated with FMC since 1954, when the Fairfield Chemicals unit was acquired by FMC. Previously, he was active in sales management with the predecessor company and, prior to that, held positions with Dow Chemical Co. and the Bureau of Entomology of the U. S. Department of Agriculture.

Mr. Rodda has been a management member of FMC's eastern operations for the past several years. During World War II, he was a unit chief in the Chemical Division of the War Production Board.

International Exhibit

The United States will be among 23 nations participating in the International Agriculture Exhibit being held in Cairo from March 21 to April 21. The U. S. exhibit is to be conducted by the U. S. Department of Agriculture in cooperation with the U. S. Department of Commerce and the U. S. Information Agency. The theme will be "Power to Produce for Peace."

Thirty scientists and technicians from the USDA and land grant colleges will travel to Cairo for the exhibit. The Agricultural chemicals unit will include a pesticide chemicals section to be run by Dr. Harold Shepard, USDA, and will contain samples of commercial pesticide products that are available in the United States.

•

Potash Deliveries Down

Potash deliveries for agricultural purposes in continental United States, Canada, Cuba, Puerto Rico, and Hawaii by the eight principal American producers and also the importers during the first nine months of last year were less than for the same period in 1959.

According to the American Potash Institute, deliveries totaled 2,810,762 tons of salts containing an equivalent of 1,643,384 tons of K_2O. This was a decrease of just under one per cent in salts and K_2O below 1959 deliveries.

•

P. J. Sullivan Retires

P. J. Sullivan, general manager of the Aroostook Federation of Farmers, Caribou, Maine, retired last month after 38 years with the fertilizer industry.

Pyrethrum Production Up

Pyrethrum production in Kenya rose by 60 per cent in the year ended June 30, 1960, and growers received $2,780,400 more than they did the previous year. Almost all of the estimated 1960-61 crop already is covered by sales contracts. Licenses issued for 1960-61 cover an estimated production of 10,300 tons from 45,000 acres. Licenses have gone to 45 African cooperatives, which deliver flowers on behalf of about 20,000 families.

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To Build In Saskatoon

A multi-million dollar chemical complex which will include Canada's first basic pesticide plant will be constructed in the Saskatoon area next spring by Interprovincial Co-operatives Ltd., Winnipeg.

•

AIChE Symposium March 22

The Chicago section of the American Institute of Chemical Engineers will hold a one-day symposium March 22 at the Conrad Hilton Hotel in Chicago. The symposium will consist of two concurrent sessions.

A session on new developments in chemical processing will cover new approaches to some chemical processes, new findings in Cryogenics, and new types of liquid-liquid separator equipment. The other session will cover new developments for engineer, management.

Heads Agronomy Group

B. R. Bertramson, chairman of the agronomy department at Washington State University, Pullman, Wash., was elected president of the American Society of Agronomy at the group's annual meeting Dec. 5 to 8 in Chicago. He replaces George F. Sprague, Agricultural Research Service, USDA. The new vice president of the society is G. W. Burton, Coastal Plains Experiment Station, Tifton, Ga.

Two affiliated organizations, the Crop Science Society of America and the Soil Science Society of America, also named new officers. J. R. Cowan of Oregon State College is the new president of the Crop Science group and R. P. Murphy of Cornell University is the new vice president.

Warner P. Nelson, midwest manager of the American Potash Institute, Lafayette, Ind., was elected president of the Soil Science group and C. A. Black, Iowa State University, elected vice president.

•

Armour Awards Contracts

Nine contracts for construction and services to implement the Armour Agricultural Chemical Co.'s $60,000,000 expansion program have been awarded by Armour and Company, Chicago, the parent company. The construction contracts cover a nitrogen plant in Colbert County near Cherokee, Ala., and a phosphate plant in Polk County, Florida. These plants, to be completed in 1962, will approximately triple Armour's present production of nitrogen and concentrated phosphate plant food materials. Upon the completion of the contracts, Armour and Co.'s investments in the chemical business will equal those of its food business.

•

Texaco Appoints Chase

Robert R. Chase has been appointed assistant to the senior vice president of Texaco, Inc., New York. Mr. Chase joined Texaco in 1941.

Method for Determining Available P_2O_5 Under Consideration

A MEETING was held in Washington, January 13, with joint participation by the Chemical Control Committee of the National Plant Food Institute and the Association of Official Agricultural Chemists to try to work out a joint policy on standard procedure for the determination of available P_2O_5 in fertilizers.

Two methods (photometric and volumetric) have been in general use by different laboratories for this determination, both official AOAC methods. The photometric method tends to give lower values than the volumetric method, the difference between the two sometimes running as much as 1%. Added to this is the inevitable variation always encountered in the way different laboratories apply the same method.

It was decided at the Washington meeting to set up a collaborative study between state officials and industry chemists in an effort to achieve a higher degree of uniformity in the results obtained by different laboratories. The existing AOAC mehods will be studied, as well as two modifications of a new method (the quinolinium method) and a gravimetric method. Upon completion of the study it is hoped that the collaborators will be able to recommend procedure which will minimize the differences currently reported in testing for P_2O_5.

The subject is a highly important one to the fertilizer industry, for it is obvious that the test method used, and the results it gives, determine what content of plant food fertilizer manufacturers must put into their formulas to ensure their meeting grade.

F. W. Quackenbush, Indiana State Chemist, and AOAC referee for P_2O_5, and William Hoffman, USDA, Beltsville, Md., associate AOAC referee for P_2O_5, attended the Washington meeting to consult with members of NPFI's Chemical Control Committee in an effort to work out a joint solution to the problem. In addition to the agreement to work together in solving the present question concerning the method for P_2O_5 they decided to set up apparatus for continuing liaison between NPFI and AOAC. James Archer, International Minerals & Chemical Corp., Atlanta, will represent NPFI's Chemical Control Committee on questions affecting phosphates, while R. L. Jones of Armour & Co. will perform the same function on nitrogen.

New Herbicide Materials

IN a special session at the 15th annual Northeastern Weed Control Conference in New York last month, representatives of the manufacturers of pesticides reported on new and experimental herbicides. (See complete story on page 32).

Among the companies represented at the special session were Eli Lilly, Amchem Products, Velsicol Chemical Corp., Rohm & Haas, and Niagara Chemical Division of Food Machinery and Chemical Corp. Lilly displayed new experimental herbicides, trifluralin and dipropalin, for seedling grass control in established turf.

Amchem Products is offering, for experimental use in liquid and granular formulations, Amiben. Niagara's latest experimental herbicide, a material developed in the Netherlands, is called Casoron and is formulated as a 50 per cent wettable powder and as a 4 per cent granular product.

New Velsicol herbicides, which will be available for extensive field testing this year, are Banvel T and Banvel D.

A postemergence herbicide, Stam F-34, is offered by Rohm & Haas as suitable for control of crabgrass. In addition, Dow Chemical's Zytron, which was introduced last year, was reported on favorably by researchers at the 1961 meeting.

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PCA Sees '61 Equal To '60

Sales and earnings of Potash Co. of America in the fiscal year ending June 30 "should be about as good as last year" when the company earned $1,744,065, John W. Hall, president, said.

He said that the company's Carlsbad, N. Mex., operation is "running at top capacity" but expensive efforts to prevent water seepage into the shaft of the company's mine near Saskatoon, Canada, continue to pull profits down.

"We have contracted to cement the shaft at a cost of about $1 million and we believe it will be successful, Mr. Hall said. The cementing procedure is expected to be completed this summer, he added.

•

Hercules Scholarship Program

Hercules Powder Co., Wilmington, Del., has announced that it is participating in the National Merit Scholarship Program beginning this year. Under the program, Hercules will award two four-year scholarships annually to children of Hercules employees.

Drift of Pesticides

An excellent article entitled "Drift of Pesticides" by Robert Z. Rollins, California Department of Agriculture, has just been published in the Quarterly Bulletin of the Calif. Department of Agriculture. Copies of the bulletin are available from the Editor, 1220 N. Street, Sacramento. Although just released, the bulletin is dated January, February and March, 1960.

Texas Gulf Sinks Shaft

Texas Gulf Sulphur Co. has finished the pilot shaft hole for its new potash mine and plant at Moab, Utah, and has awarded a contract for the design and construction of a surface plant. The new facilities, which could cost $25 million, depending on the size of the mine shaft required, will be the first to begin producing in Utah.

The planned capacity of the plant is one million tons per year. In addition, Texas Gulf expects that the good quality of the ore will allow it to produce a product that is essentially pure potassium chloride — that is, 61-62 per cent potassium oxide equivalent. This high-quality product should give Texas Gulf a good competitive position in a market where standard is 60 per cent potassium oxide.

•

PCA Office Completes Move

The general sales office of the Potash Company of America has completed its move from Washington, D. C., and now is located at Suite 1718, 630 Fifth Avenue, New York.

•

New Antitrust Suit

In the first application of the Clayton Act against a jointly-owned subsidiary, the Justice Department has brought an antitrust suit against Penn-Olin Chemical Co.

In filing the suit in federal district court at Wilmington, Del., last month, Antitrust Chief Robert Bicks charged that the proposed Penn-Olin sodium chlorate project —owned 50-50 by Pennsalt Chemicals and Olin Mathieson Chemical Corp. — would "lessen competition and strengthen barriers to the entry of new producers."

The parent companies deny this, saying that their venture would actually "introduce an efficient new producer to the field."

•

Expect Canada Potash By '62

Canada's first potash mine is expected to be producing steadily by late 1961 or early 1962. International Minerals & Chemical Corp., (Canada) Ltd. is investing at least $25,000,000 in its mine at Bairomore, Saskatchewan. That is $11,000,000 more than orginally budgeted, first because of water seepage — now sealed off — and next because it became necessary to freeze a layer of sand to 50 degrees below zero in order to sink the mine shaft. A surface refinery to treat and process the mined potash already has been completed.

•

Fourth Co-op Expansion

A fourth major expansion of the Cooperative Farm Chemicals plant east of Lawrence, Kansas, has been announced by R. R. Zurbuchen, plant manager. The new addition will cost approximately $1 million and will result in a doubling of the plant's capacity to produce urea-nitrate solutions.

The expansion is scheduled to be completed in April of this year.

Edward Block Dies

Edward Block, senior vice president and general manager of the chemical division of Olin Mathieson Chemical Corp., Baltimore, died Jan. 4 in Johns Hopkins Hospital, Baltimore. His age was 58.

A 1923 graduate of the University of Chicago, Mr. Block was an engineer for the Superior Chemical Co. until 1930. For the next three years he served as manager of the Joliet, Ill., plant of American Cyanamid Co. He was appointed secretary-treasurer of the Blockson Chemical Co. in 1933 and remained in that post until the company's acquisition by Olin Mathieson in 1955. Mr. Block was a member of the board of Olin Mathieson.

John O. Logan has been appointed to succeed Mr. Block as general manager of the division.

•

Bemis Appointments

Three appointments within the sales operations of the Bemis Bro. Bag Company were announced by C. W. Akin, executive vice-president.

George W. Finlay has been named manager of the Wichita bag plant and sales division and will be succeeded as supervisor for multiwall bag sales in the company's general sales department in St. Louis by U. A. Tull. The latter's post as sales manager of the Memphis sales division will be filled by Donald H. Woodmansee, Jr.

•

Fungicide Symposium

The pesticides group of the Society of Chemical Industry, London, will hold a symposium on the use of fungicides in agriculture and horticulture, March 20 to 21, at 14 Belgrave Square, London, England. Among the speakers will be Dr. F. C. H. Gayner, Plant Protection Ltd., "Recent Developments and Current Usage of Fungicides in Agriculture"; Professor van der Kerk, Organisch Chemisch Instituut T.N.O., "New Developments in Organic Fungicides"; D. J. Higgons, Boots Pure Drug Co., who will discuss Allisan (2,6-dichloro-4-nitro-aniline); and Dr. W. F. Jepson, Cyanamid International, who will discuss Melprex, dodine (dodecylguanidine acetate).

Joint Midwestern Meeting To Be Held In Chicago Feb. 16

FIVE major features ranging from a study of demonstrations as "door-openers" to plant food sales, the banker's function in fertilizer credit, and the impact of research on fertilizer use, will headline the 13th annual joint meeting of Midwestern Agronomists and Fertilizer Industry Representatives at Chicago, February 16 and 17.

The two-day sessions at the Edgewater Beach Hotel will be sponsored by the National Plant Food Institute's Midwest regional office. Among speakers scheduled are: Dr. D. G. Aldrich, University of California, dean of agriculture, statewide; Douglas R. Graves, Harris Trust & Savings Bank, Chicago; Dr. Everett Rogers, agricultural economist and Dr. Gordon Ryder, extension agronomist Ohio State University; and Dr. Marvin Beatty, extension soils specialist, University of Wisconsin, Madison, Wisconsin.

Heyden Newport V.P.

E. C. Slaght Jr. has been appointed vice president and technical director of Newport Industries division, Heyden Newport Chemical Corp., Pensacola, Fla. He had been manager of Heyden Newport's market development department in New York.

•

Retires As Armour Manager

Robert White has retired as general manufacturing manager of Armour Agricultural Chemical Co., after 42 years of service Mr. White is being retained by the company as a consultant on fertilizer manufacturing operations.

Appointed general manufacturing manager for the fertilizer-manufacturing firm in 1955, Mr. White went to Atlanta in 1934 as general superintendent of all of Armour's fertilizer operations. Previously, he was associated with Armour's Baltimore and Carteret fertilizer plants.

•

To Join Union Bag

Dr. William H. Aiken will join the Union Bag-Camp Paper Corp. on February 15 as director of research and development.

Prior to joining the Union-Camp organization, Dr. Aiken directed research and development for Gardner Board and Carton Company and its successor, the Diamond Gardner Corporation. Most recently he served both as a director and vice president, research and development engineering, of Personal Products Corporation, one of the Johnson & Johnson companies.

•

PPG Consolidates Operations

Columbia-Southern Chemical Corp., a wholly-owned subsidiary, has become a division of Pittsburgh Plate Glass Co., Pittsburgh, Pa. The new division is operating under the name of Pittsburgh Plate Glass Co., Chemical Division. The principal officers of Columbia-Southern have been elected as officers of Pittsburgh Plate. Joseph A. Neubauer has been named vice president and general manager, chemical division, and Chris F. Bingham has been named vice president—chemical sales.

•

Niagara Breaks Ground

Groundbreaking ceremonies for a new research center were staged at Middleport, New York, recently by the Niagara Chemical Division of Food Machinery and Chemical Corporation. The occasion marked official commencement of work on the facilities which are expected to be ready for occupancy by October.

•

Smith Advanced By Dow

Hillard L. Smith has been named assistant to the manager of agricultural chemical sales for the Dow Chemical Co., Midland, Mich. He has been with Dow since 1944 and for the past five years has acted as manager of the sales planning section of Dow's agricultural chemicals sales department.

•

Fertilizer Unit Burns

A fire destroyed the Johnson Cotton Co. fertilizer plant in Dunn, N. C., last month. Damage is estimated at more than half a million dollars.

Doolan Fills New Post

William S. Doolan has been appointed district sales manager of the newly-created South Atlantic district of the bag division, St. Regis Paper Co., New York. The district is comprised of Georgia, South Carolina, western North Carolina, and eastern Tennessee. Mr. Doolan's headquarters are in Savannah, Ga.

•

D-K Names Campbell

Davidson-Kennedy Co., Atlanta, Ga., machinery manufacturer, has named Tom C. Campbell vice president. He will also serve as president of Manufacturers Products Company, a wholly owned subsidiary.

Prior to joining Davidson-Kennedy, Mr. Campbell was regional manager of Foote Bros. Gear and Machine Corp. formerly Whitney Chain Company.

•

Monsanto Plant Expansion

Monsanto Chemical Co. has announced the completion of a 50 per cent expansion of its plant for manufacturing parathion and methyl parathion insecticides. The plant is in Anniston, Alabama. The facility now has an annual capacity of 18 million pounds.

Washington Bankers Meet With Fertilizer Industry

FORTY bankers and members of the Yakima Valley fertilizer industry met recently at Grandview, Wash., to discuss the dollars-per-acre necessary to finance farmers in the area for their fertilizer and agricultural chemical needs.

Warren Mallory, Collier Carbon & Chemical Co., emphasized the importance of soil testing to a good soil fertility program. "Perhaps the bankers should consider making it mandatory for the farmer to have his soil tested as one of the prerequisites for a loan," Mr. Mallory said.

Mimeographed copies of fertilizer recommendations for the important crops in the area were distributed by Todd Tremblay, regional director of the National Plant Food Institute. He said that the recommendations and dollars per acre figures presented will produce optimum yields for farmers who observe other good management practices.

John Thomas, Simplot Soil Builders, discussed various farm chemical recommendations for the various crops and said that unless a certain number of dollars per acre are set aside for farm chemicals on crops such as potatoes, hops, and mint, the farmer may find himself in a bind during the growing season. By paying attention to agricultural chemical needs, the banker will make a more secure loan on fertilizer and seed, Mr. Thomas stated.

Shade Tree Conference

The 16th annual meeting of the Midwestern Chapter, National Shade Tree Conference will be held Feb. 15 to 17 at the LaSalle Hotel, Chicago. Among the speakers on the program are David E. Donley, U. S. Forest Service, Delaware, Ohio, who will discuss recent research on systemic insecticides as a tool in shade tree insect control; and Donald L. Schuder, Purdue University, Lafayette, Ind., who will discuss the proper use of insecticides.

In a symposium on Dutch elm disease, a report on the use of Methoxychlor will be given by Dale Norris of the University of Wisconsin, Madison.

•

Education Committee Formed

A joint committee has been activated to stimulate enrollment in agricultural courses in California's four-year colleges. The committee's efforts are aimed primarily at the class counselors of high schools and junior colleges. Weir Fetters, who represents the Soil Improvement Committee of the California Fertilizer Association, is head of the committee.

Others on the committee include: Byron J. McMahon, chief, California Bureau of Agricultural Education; Dr. Perry Stout, chairman, Department of Soils and Plant Nutrition, U. of California, Davis; O. Raynal Lunt, Associate Soil Scientist, UCLA; Dr. Arnold Dean and Robert E. Procsal, both of California State Polytechnic College; and Lloyd Dowler, Dean of Agriculture, Fresno State College.

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Arizona Firms Merge

Southwestern Agrochemical Corp., Chandler, Ariz., has acquired the assets of the Kerley Chemical Corp., Kyrene, Ariz. R. V. Kerley, president of Kerley Chemical Corp., has become sales manager of the merged organizations which are operating under the name of the Southwestern Agrochemical Corp. The Kerley Company has been a manufacturer of insecticides and ammonium polysulphide and distributes ammonia and other fertilizers throughout central Arizona.

Southwestern Agrochemical operates a sulfuric acid and ammonium phosphate plant at Chandler, together with an 80 ton per day ammonia plant through Southwestern Nitrochemical Corp., an affiliated company.

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Mexican Group Elects

Lauro Navarro, Distribuidora Shell de Mexico, was elected president of the Mexican Association of Insecticide and Fertilizer Manufacturers at their annual convention held Dec. 5 to 9 in Merida, Mexico.

Others elected to the board of directors for 1961 include: Alfonzo Delgado de Garay, Quimicas Unidas, vice president; Alfonso Leyva, Pennsalt de Mexico, secretary; Salvador Dominguex, Agencias Agricolas Mexicanas, assistant secretary; Raul Suarez, Productos DDT, treasurer; Javier Gonzalez, Quimica Niagara de Mexico, assistant treasurer; and Ricardo Minguia, Diamond Chemicals de Mexico, and Jack L. Schack, Montrose Mexicana, members of the council.

The group's next meeting is scheduled to be held at La Paz, Lower California, starting Nov. 21, 1961.

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54th Canners Meeting

The 54th annual convention of the National Canners Association was held Jan. 23 to 25 in Chicago. Among those on the program were Dr. Ordway Starnes, N. J. Agricultural Experiment Station, New Brunswick, and Dr. W. L. Popham, assistant administrator, regulatory problems, Agricultural Research Service, USDA.

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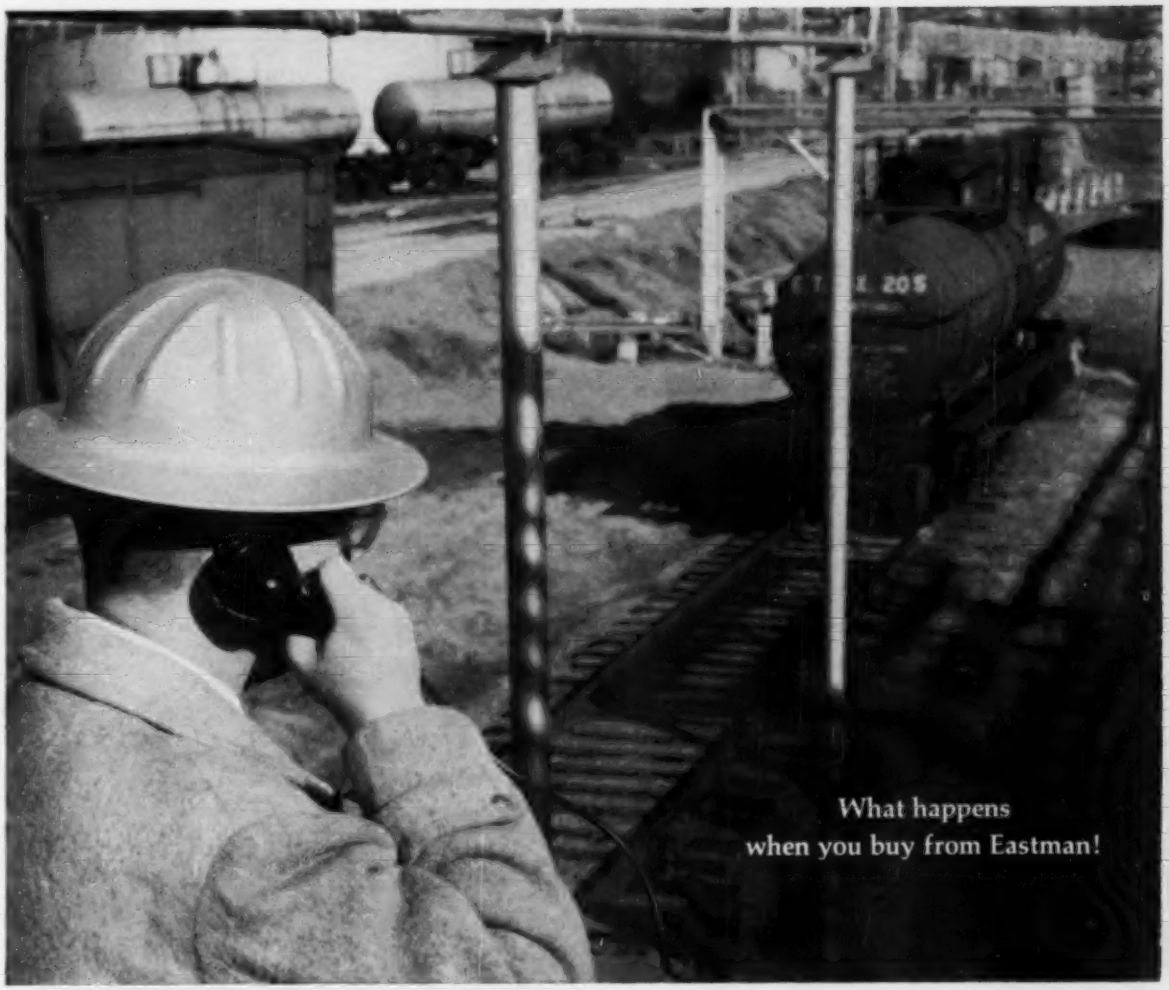
Ischinger Joins AP&CC

Dr. Richard G. Inschinger has joined the American Potash & Chemical Corp., Los Angeles, as head of the firm's Whittier Laboratory pilot plant section.



Long distance unloading

"I guess I've personally unloaded or supervised the unloading of better than 20,000 tank cars," said our materials handling supervisor, "but this was the first time I ever tried to unload one by long distance telephone.

"The plant manager who called was considerably embarrassed by the whole situation. He runs a small, efficient processing plant and is a good customer of ours for Tecmangam® (manganese sulfate), which he uses in his line of feed supplements. But the particular material he wanted to unload was not Tecmangam. In fact it did not even originate at our plant. It came from another supplier whom he had been unable to reach by telephone.

"The situation was further complicated by the fact that not only was his unloading foreman off sick but this was the first time they had ever received this particular material. He said he did have a fresh-out-of-college chemical engineer handy, but this young man had assured him that tank car unloading had not been a prerequisite for his degree. I thought maybe I could work it out with him over the telephone anyway, so I asked if I could talk to the new alumnus.

"Well, I outlined the entire procedure covering everything from foot valves to vent seals. Then he said, 'Would you run that by again?'

"So I did, several times. And about fifteen dollars later we had the tank car hooked up and unloading. And I now know a proud young chemical engineer who could probably unload a tank car blindfolded—because he had to learn it the hard way."

When it comes to service—we mean business, even if it's not always our own.

Eastman CHEMICAL PRODUCTS, INC., KINGSPORT, TENNESSEE, Subsidiary of Eastman Kodak Company

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tennessee; Atlanta; Boston; Buffalo; Chicago; Cincinnati; Cleveland; Detroit; Greensboro, North Carolina; Houston; Kansas City, Missouri; New York City; Philadelphia; St. Louis.
Western Sales Representative: Wilson & Geo. Meyer & Company, San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

Control cotton seedling diseases

One application of TERRACLOR®

Terraclor and combination fungicides save cotton . . . save money

The major cotton seedling disease of Rhizoc Damping-Off or "soreshin" is effectively controlled by Terraclor soil fungicide, providing healthy, vigorous stands with the first planting. Terraclor may be combined with certain other fungicides for effective control of disease complexes. Such fungicides are Captan, Thiram, Phygon, Zineb, and Maneb.

Soil-borne fungi such as Rhizoctonia solani, Pythium and Fusarium are responsible for skips and uneven stands or even destruction of entire fields of young plants. When this occurs, replanting is necessary. This can amount to 10-25% of cotton acreage annually.

Terraclor and Terraclor combination fungicides are now accepted as a standard cultural practice in many cotton producing areas . . . proved over more than five years as the effective, profitable way to control cotton seedling diseases.

May we discuss soil fungicides with you or send you additional information? Your request will receive our prompt attention.

OLIN MATHIESON CHEMICAL CORPORATION
Insecticide Products Department, Baltimore 3, Maryland
Fresno, Calif. • East Point, Ga. • Denver, Colo. • Dallas, Tex.

. . . ELIMINATE REPLANTING

Fungicide at planting does it!

1. Eliminates skips 2. Provides better stands 3. Promotes bigger yields

Here's the damage: Every year cotton seedling diseases cost the growers an estimated $70 million . . . destroy about 3 bales for every 100 ginned, or almost 400,000 bales annually . . . cost the growers in seed, time and labor.

Here's the *TERRACLOR* profit picture:

1. Permits earlier planting with greater safety.
2. Provides vigorous, uniform stands with first planting.
3. Insures against replanting costs—saves seed, time, labor.
4. Insures against waste of valuable soil moisture by eliminating replanting.
5. Permits reduction of excessive seeding rates.
6. Develops better root systems.
7. Protects a good stand.
8. Provides healthy seedlings . . . earlier cotton.
9. Permits some boll set before cotton root rot disease attacks in certain areas.
10. Permits earlier harvest . . . and better grade of cotton if harvested before Fall rains.
11. Provides (through uniform, better stands) more efficient mechanical harvesting . . . better weed and insect control . . . more efficient use of plant nutrients and water.

8970

Other Crop Uses

Cabbage, Cauliflower, etc.	Club Root and Black Root or Wire Stem
Tomatoes, Peppers	Southern Blight
Beans	Root and Stem Rot, Sclerotinia White Mold
Peanuts	Southern Blight (Southern Stem Rot)
Potatoes	Scab, Rhizoctonia
Lettuce	Leaf Drop, Bottom Rot
Alfalfa, Clover	Crown Rot
Wheat Seed	Common Smut or Bunt
Garlic	White Rot
Celery*	Pink Rot, Damping-off
Onions	Smut, Sclerotium Rot
Mushrooms*	Mildew, Lipstick Mold
Strawberries*	Botrytis, Black Root, Red Stele
Ornamentals	Stem Rot, Crown Rot, Black Rot, Root Rot, Botrytis, Flower Blight
Turf	Brown Patch

TERRACLOR® is a trademark.

*Experimental use only

Contracts to C&I

Contracts for construction of an ammonium nitrate plant and a nitric acid plant at Fort Madison, Iowa, have been awarded to the Chemical & Industrial Corporation of Cincinnati, Ohio, by the California Chemical Company, a subsidiary of Standard Oil Company of California, San Francisco.

Fred Powell, California Chemical's president, said the two units, part of a complex of chemical fertilizer plants that the Company is building at Fort Madison, are expected to be completed in the fall of 1961.

Plant capacities for the two units will be 150-200 tons per day for the ammonium nitrate plant and 250 tons daily for the nitric acid plant.

•

U. S. Borax Sales Set Record

United States Borax & Chemical Corp., Los Angeles achieved record sales and earnings for the fiscal year ended Sept. 30, 1960. Sales for the year amounted to $66,654,174, a gain of seven per cent over the previous year. Net income of $6,920,209 was 14 per cent higher.

James M. Gerstley, company president said, however, that, although an increase was registered in potash tonnage sales, the profit margin remained unsatisfactory because of the low prices which prevailed in both domestic and import markets. But he looked for the full benefits of a price increase, which became effective July 1, 1960, to be reflected in 1961.

•

Federal Approves Merger

Federal Chemical Co., Louisville, Ky., has approved a merger with National Distillers and Chemical Corp., New York. Federal Chemical manufactures mixed fertilizers at six plants in Illinois, Indiana, and Ohio.

Federal Chemical will be operated by National Distillers under the Federal name and by the present Federal management and operating personnel as a division of National Distillers. Jefferson D. Stewart Jr. is head of the division.

•

Calhoun Joins Geigy

Leo K. Calhoun has joined the Alabama sales staff of Geigy Agricultural Chemicals, division of Geigy Chemical Corp., Ardsley, N. Y. Mr. Calhoun had been with the sales department of California Spray Chemicals Corp. His headquarters are in Columbus, Ga.

Elected To Climax Board

Thomas W. Childs and Wallace Macgregor have been elected members of the board of directors of American Metal Climax, Inc., New York. Mr. Childs, who joined the company in 1958, is a vice president of the company and president of the subsidiary, Southwest Potash Corporation.

Mr. Macgregor, also a vice president of American Metal Climax, is president of the Climax Molybdenum Company division, which he joined in 1950.

•

Sees Improved Sales In '61

Dr. Leland I. Doan, president of the Dow Chemical Co., Midland, Mich., said last month that he expects sales of the chemical industry during 1961 to improve somewhat more than the average of other industries because of "its diversification and its basic position as supplier to all other major industries." He was less optimistic on the industry's profit potential, however, noting the profit squeeze which has been "growing in intensity for several years" and which he still regards as the industry's number one problem.

Competition is still increasing, he said, both from domestic production and chemical imports, and while strong competition is essentially a creative force it none the less represents a very serious problem for the individual company which must be met realistically.

•

New Michigan Laboratory

The Michigan Department of Agriculture has opened the William C. Geagley laboratory at East Lansing. The new laboratory consolidates technical, scientific, research, and control regulatory problems handled by the department.

It is named after William C. Geagley, who retired as head of the Michigan Department of Agriculture's laboratories division late last year. Mr. Geagley served the state as a chemist for more than 47 years.

Seed Treatment & Wild Life Are Topic of Meeting In England

THE Ministry of Agriculture, Fisheries and Food, London, recently sponsored a meeting to discuss the evidence of the dangers of seed treatments to wild life, and to explore means of minimizing undesirable effects. Among the conclusions reached at the meeting — which was attended by representatives of conservation groups, farmers, chemical manufacturers, and regulatory groups— were that seed treatments play a very valuable part in agricultural production; that not all seed treatments present a hazard to wild life; but, there is evidence that seed treatments containing dieldrin, aldrin, and heptachlor can kill birds that eat treated seed; and there also is some evidence that deaths of foxes and other predators may have occurred through eating birds that have died through ingesting these chemicals.

It was agreed that further experimental work will be done by the Ministry of Agriculture, Fisheries and Food and the Laboratory of the Government Chemists and the chemical manufacturing companies. In addition, the Ministry is planning a publicity program to keep farmers informed about possible risks to wild life and to warn against illegal spreading of treated grain. This publicity also will draw attention to the care needed to dispose of any surplus treated seed and will caution against mixing it with untreated seeds or feeding it to livestock.

International Market Roundup

INTERNATIONAL trade in fertilizers is beginning to become more intense, with substantial inquiries from Indonesia still circulating, although no purchases have been made as yet. Also, a substantial tender is being held in Korea probably early in February, with the Korean Government and private importers purchasing a total of $30 million worth of nitrogen, P_2O_5 and K_2O. Preference is to be given to American produced fertilizer on the 60% of the total allocation being purchased by the Korean Government provided, however, that the price differential between American produced material and foreign produced material is not too substantial. The degree to which a higher price will be paid for American material has not been announced by Washington. The material being purchased by private traders will be bought on a world-wide basis, with lowest landed cost to govern.

India has negotiated during January to purchase approximately 240,000 tons of nitrogenous fertilizers, while the Pakistan government negotiated the purchase of approximately 100,000 tons of various materials. The Formosan Government has been announcing tenders for ammonium sulphate from world-wide sources, although this country traditionally has been purchasing its nitrogenous requirements from Japan under the terms of a bi-lateral trade agreement.

The big hold-out continues to be Communist China, whose sharply reduced purchases are attributed to internal difficulties, as well as shortage of foreign exchange.

Complied by International Ore & Fertilizer Corp., New York

•

Form European Producer

American Potash and Chemical Corp., Los Angeles, has joined with the French firm Societe D'Electro-Chimie D'Electro Metallurgie et des Acieries Electriques D'Ugine in the formation of a new company, SEUROBOR, (Societe Euporeene du Bore) that will construct a $2,000,000 facility to produce boric acid in France for the European market.

The plant will be located at Pierre Benite, near Lyons. "Ugine" will manage the manufacturing activities of the new operation and Borax & Chemicals, Ltd., European selling organization of American Potash, will market the production of the new plant.

•

Chilean Nitrate Problems

The annual report of Anglo-Lautaro Nitrate, London, warns that substantial relief in the exchange situation must be forthcoming promptly if a drastic deterioration of the company's position is to be avoided. Pressure of internal costs has now reached proportions which operations are unable to sustain, the report states, and the absence of any indication of relief in the near future "constitutes a matter of grave concern for the company and the Chilean nitrate industry."

•

Knapp Joins Geigy

Douglas Knapp has joined Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N. Y., as a field representative. Mr. Knapp represents Geigy in southern Florida. He had been assistant county agent with the Dade County (Florida) Agriculture Department.

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FDA Tolerances Listing

The December, 1960 issue of *NAC News and Pesticide Review*, published by the National Agricultural Chemicals Association, carries a full list of official tolerances for pesticide chemicals in or on agricultural commodities as established by the Food and Drug Administration, U. S. Department of Health, Education, and Welfare. It is the seventh annually revised listing published by NAC.

Di-Mon Patent To USPP

U. S. Patent No. 2,963,359, covering an improved process for manufacturing di-ammonium phosphate, has been issued to George F. Moore and Thomas Beer, assignors to the Tennessee Corp., New York. The granular modified di-ammonium phosphate, 18-46-0, is marketed under the trade name Di-Mon by the U. S. Phosphoric Products Division of the Tennessee Corp., Tampa, Fla.

The patent covers a process which is unique in that the reaction and granulation are accomplished in an unusually simple flow. The process flow is well adapted to positive control, which results in a uniform product.

•

Snell Acquires Subsidiary

Foster D. Snell, Inc., New York, has acquired Calkin & Bayley, Inc., New York industrial consultants. The acquisition will be operated as a wholly-owned subsidiary of the Snell firm, with George T. Bayley, C&B's former president and board chairman, acting as vice president in charge of the Calkin & Bayley division of Foster D. Snell.

At the same time, Snell announced its decision to close its Davis & Bennett division at Worcester, Mass., "as soon as work in progress can be completed."

•

Pesticide Chemicals School

The 10th annual Pesticide Chemicals School, sponsored by the department of entomology and zoology and the department of botany and bacteriology, Clemson College, will be held at the Clemson House, Clemson, South Carolina, from February 28 to March 1.

•

Heads Minnesota Group

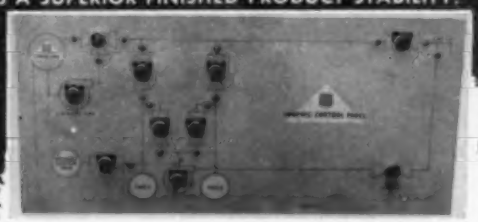
John M. Coates has been elected president of the Minnesota Fertilizer Industry Association, Minneapolis, Minn. He is district sales manager of plant foods for International Minerals & Chemical Corp., Skokie, Ill.

MODERNIZE YOUR PLANT

. . . AND GET SET FOR PROFITS

WITH B&L'S CONTINUOUS AMMONIATION PROCESS

IN-PLANT OPERATIONS HAVE PROVEN THE EXCLUSIVE B&L CONTINUOUS ACID NEUTRALIZATION PROCESS PRODUCES A SUPERIOR FINISHED PRODUCT STABILITY.



GRAPHIC CONTROL PANEL

Furnished as standard equipment on the B&L Autobatch line and provides remote control and operation of various components together with visual indication of the sequence involved.

THE B&L AutobatcH

Designed specifically for converting standard batch operated plants to the proven continuous ammoniation process. Fully self-contained unit, pre-piped and wired for fast economical installation. Now, YOU, can take advantage of over a hundred years of processing engineering experience now offering outstanding design and development in the field of Liquid Fertilizer Units. An easily installed "complete package" unit is now available giving you fully automatic, centralized one-man operation.

WE'LL HELP YOU SELECT THE RIGHT EQUIPMENT FOR YOUR EXPANSION PROGRAM.

FOR FULL DETAILS WRITE . . .

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BARNARD & LEAS *Manufacturing Company* INC.

Since 1854

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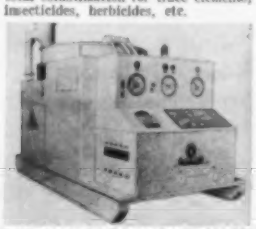
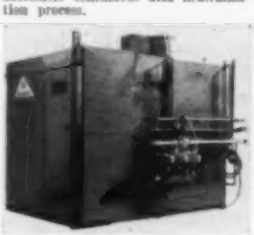
THE B&L LiquibatcheR
An exceptional low cost batch processing unit. Features semi-automatic operation.

THE B&L LiqualizeR
Standard or scale mounted models. Exclusive "whirlpool" action, positive total solubilization for trace elements, insecticides, herbicides, etc.



THE B&L AutobatcH SKID PLANT
Ultimate in batch-type "complete package" units. Features the fully automatic continuous acid neutralization process.



THE B&L ConcteR
High capacity continuous flow neutral solution liquid fertilizer processing unit. Provides a complete installation at low investment.

THE B&L ConvertoR
Automatic or manually controlled liquid nitrogen, "package units" for converting anhydrous ammonia to aqua ammonia.

Fertilizer Evaluation Conf.

Nearly 100 scientists representing universities, industry, and governmental agencies in 25 states and Canada attended the annual Fertilizer Evaluation Conference at the Tennessee Valley Authority's Fertilizer - Munitions Development Center, Muscle Shoals, Ala., Jan. 25 and 26.

A feature of the meeting was a symposium on "Effects of Environment on Crop Response to Fertilizers" in which soil moisture and crop yield relationships were considered as well as the effect of temperature on nutrient uptake by plants.

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To Finance Indian Plant

The Development Loan Fund, Washington, D. C., has signed an agreement to lend India $30 million for a fertilizer plant. The loan will be used to finance the foreign exchange costs of construction of the government-sponsored Hindustan chemical and fertilizer plant.

In addition, the U. S. is lending $28 million of U. S.-owned Indian rupees to finance the local costs of the plant.

•

New Sales District

Chipman Chemical Co., Bound Brook, N. J., has established a new sales district which includes the states of Minnesota, North and South Dakota, and part of Wisconsin. Donald Horne has been appointed manager of the district. He maintains offices in St. Paul, Minn., where the company also has a manufacturing plant.

•

Porter Succeeds Crissey

John Porter has been named manager of the Soil Building Division of G.L.F., Ithaca, N. Y. He replaces J. C. Crissey, who retired Jan. 1. Mr. Porter had been with Iowa Farm Bureau Service as manager of the fertilizer and seed division.

•

Tharp Joins Cotton Council

Dr. W. H. Tharp, physiology investigations leader, Cordage Fibers Research Branch, USDA, Beltsville, Md., has joined the National Cotton Council as physiologist in the production and marketing division. Dr. Tharp had been with the USDA for 25 years.

•

Munger Joins T-H

Glenn O. Munger has joined the agricultural chemical division of Thompson-Hayward Chemical Co., Kansas City, Mo., as grain sanitation director, a new post.

Federal Buys Plant

Federal Chemical Co., Louisville, Kentucky, a Division of National Distillers & Chemical Corporation has purchased a fertilizer plant at Whitewater, Wisconsin from the Wisconsin Farmco Service Cooperative. The plant produces high analysis, fully pelleted, commercial fertilizers. The Whitewater plant is located 45 miles southeast of Madison, Wisconsin.

BOOK REVIEWS

Modern Fruit Science, by Norman F. Childers. Published by Horticultural Publications, Rutgers University, New Brunswick, N. J. 893 pages, price $7.50.

Although this book was intended primarily for undergraduate use, it contains enough practical information in easy-to-read form that it should be of value also to the grower of fruits and nuts who desires to keep abreast of trends and research developments. A special effort obviously has been made to present the subject material in an attractive, logical manner. Numerous photographs and charts illustrate the text, and the appendix provides the reader with detailed information that sometimes cannot be found in other books, plus an additional set of technical references on key subjects.

Apples, of course, receive the lion's share of attention, but such other fruits as pears, quince, peaches, apricots, cherries, strawberries, and grapes are thoroughly covered; as are edible nuts and minor tree crops. An extremely comprehensive chapter covers the control of insects and diseases. Spray schedules, tolerances, formulations, and spray machinery are among the topics covered in detail in this chapter.

The author is a professor and research specialist in horticulture at Rutgers University. His previous experience includes assignments as assistant director and senior plant physiologist with the USDA experiment station in Puerto Rico and as associate in horticulture with the Ohio Agricultural Experiment Station.

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Forest and Shade Tree Entomology, by Roger F. Anderson. Published by John Wiley & Sons, New York. 428 pages, price $8.50.

The first section of this book deals with basic facts about insects, and insect life, such as insect structure, physiology, development, classification, and ecology. In addition, the more specialized subjects of forest insect surveys and control methods are discussed.

The second and larger section of the book treats individually the more imoprtant forest, shade tree, and wood products insect pests. Identification aids consist of descriptions, figures, and tables that stress characteristics observable in the field.

The book, therefore, not only offers a fundamental understanding of insect life, it also prepares the reader to deal with actual forest insect problems. Because of this, the book should be of value to actual forest service entomologists as well as students.

The author is at present professor of forest entomology at the School of Forestry of Duke University. His previous experience includes work as an entomologist in the Forest Insect Division of the U. S. Department of Agriculture. He also has taught at the University of Georgia.

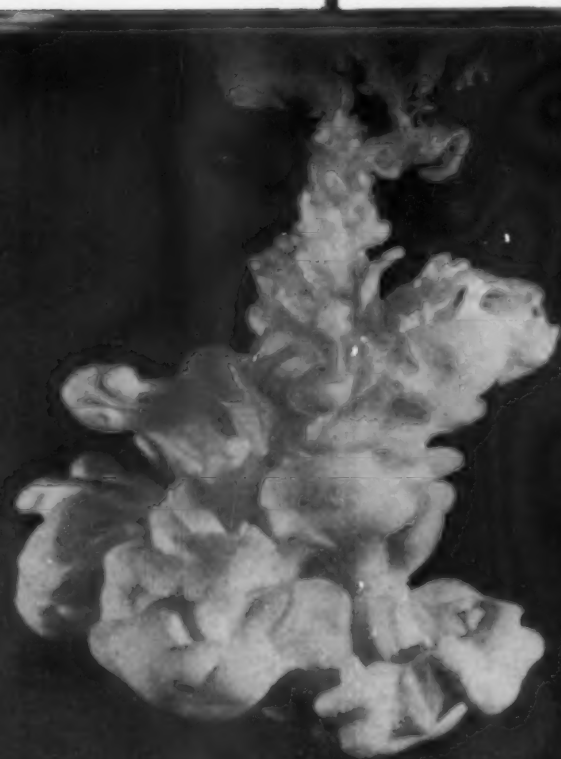
BALANCE MAKES THE DIFFERENCE...

...in solving problems that involve surface active agents. The perfect balance of many components is often required to create an emulsifier to assure optimum performance. Proper balance also means savings through more economical emulsifier levels.

Witco's Emcol surface active agents offer the chemist the broadest latitude in solving problems involving emulsification, dispersion, and other colloidal effects. The Emcol line includes anionic, nonionic, and cationic products. For more information on these versatile materials, send for your copy of Witco's brochure describing the "Emcol Surface Active Agents". Write to Technical Service Department 340.

1 Two immiscible phases separate immediately when a hydrocarbon solvent containing no emulsifier is poured into water.

2 The same solvent containing 3% of a poorly balanced blend of anionic-nonionic emulsifiers forms only a fair emulsion in water.



3 The spontaneous "bloom" of a good emulsion dispersing in water results from the perfect balance of an Emcol emulsifier at the same 3% concentration.

EMCOL DIVISION

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Sales Offices in Chicago • Boston • Akron • Atlanta • Houston • Los Angeles
San Francisco • Toronto and Montreal, Canada • London and Manchester, England
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NPFI Lists Changes

Dr. Willard H. Garman, formerly chief agronomist and Northeastern regional director for the National Plant Food Institute, Washington, D. C., has been named chief agriculturist for NPFI. He is stationed in Washington. Merle V. Adams has been named to succeed Dr. Garman. He had been district representative for the Northeastern region.

In other moves, Louis H. Wilson, NPFI secretary and director of information, was named to head the newly-created division of informational services, combining information, publications, and visual aids. Other division personnel include Lee Conahan, who serves as editor of the *Weekly News Report*, and Jerry B. Davis, who is editor of the *Plant Food Review*.

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Heads Texas City Plant

James F. Roe has been appointed manager of the Texas City, Texas, operation of Smith-Douglass Co., Inc., Norfolk, Va. Mr. Roe had been with International Minerals & Chemical Corp., as general manager of IMC's Bonnie, Fla., chemical plant.

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DuPont Grants $1.4 Million

Grants totaling more than $1,400,000 have been awarded to 159 universities and colleges in the DuPont Co.'s annual program of aid to education. The program is for fundamental research by universities, for strengthening the teaching of science and related subjects, and for facilities for education or research in science and engineering.

The largest part of the program ($654,000) is to help strengthen the education of scientists and engineers. In addition, grants for fundamental research in 1961-61 total $475,000. An additional $50,400 was awarded for summer research grants to enable staff members of universities to undertake research of their own choosing during the summer. A $250,000 fund was authorized to help with the cost of new building, equipment, or renovation of existing science and engineering facilities.

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D. L. Odle Joins Geigy

D. L. Odle has joined Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N. Y., as a sales representative in Iowa. His headquarters are in Des Moines.

Stauffer, Dow Suit Settled

Stauffer Chemical Co., New York, and Dow Chemical Co., Midland, Mich., have announced that the infringement suit involving Dow's patents on the production of chlorinated solvents has been settled. Under the terms of the settlement, Stauffer will be licensed under the Dow patents and Dow will receive consideration totaling approximately $1,500,000.

Farm Fertilizers Appoints

Arthur C. Jetter has been appointed vice president and secretary of Farm Fertilizers, Inc., Omaha, Nebr. He had been secretary and assistant treasurer of the company. Armwell J. Joines has been named assistant treasurer.

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Ortho Fertilizer Group

The Ortho Division of California Chemical Co., Richmond, Calif., has organized a national fertilizer group. The group, formerly concerned only with the company's western operations, consists of William E. Jaqua, national manager of fertilizer sales; L. R. Hamilton, assistant national manager, fertilizer sales; and Dr. M. H. McVickar, chief agronomist.

M. E. Wierenga, vice president and marketing manager of the division, said that the move is connected with the Ortho entry in the fertilizer marketing area of the northern United States.

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Michigan Chemical Names 3

Michigan Chemical Corp., St. Louis, Mich., has appointed Thomas B. Sparks as manager, market research and development, of its Chemical Division. Carl H. Pfrommer has been named product manager, magnesia sales, and George J. Coleman Jr. has joined the company as a technical sales representative in the company's eastern sales territory.

Mr. Sparks had been product manager, Chemical Division. Mr. Pfrommer had been eastern sales manager for the past four years, and Mr. Coleman had been with Whitehall Laboratories Division of American Home Products Corp.

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Arthur A. Schultz Retires

After 46 years of service with Reading Bone Fertilizer Co., Reading, Pa., Arthur A. Schultz has retired from the firm. He continues to serve as chairman of the board of directors, however, and is active as president of By-Products, Inc., a corporation which will be buying and selling by-product ingredients, such as feather meal and poultry by-product meal.

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To Manage Best Subsidiary

John Clark has been appointed vice president and general manager of Best Chemicals and Fertilizers Co., Ltd. of Hawaii, a new subsidiary of Best Fertilizers Co., Lathrop, California. Mr. Clark had been manager of the chemical division of Alexander & Baldwin, Ltd. He is a native of Hawaii.

The Hawaiian subsidiary will serve as distributor for a number of producers of agricultural and industrial chemicals. Headquarter offices recently were opened in Honolulu.

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Sludge Processing Firm

Portland, Oregon, has authorized Grow-All, Inc., to build a fertilizer plant next to the city sewage disposal plant. The new firm will utilize the entire output of sludge from the sewage plant and also will use surplus gas from the disposal plant to process the sludge. The sewage plant waste will be dehydrated and processed for fertilizer.

The arrangement is in the form of a five-year lease, with an additional five year option for a plant site and the output of the sewage plant. After the first six months, Grow-All will pay a site rental of $50 per month and $1.50 a ton for sludge. The gas will be purchased at a rate of 10 cents per 1,000 cubic feet.

Correction

A news item on page 74 of our December, 1960 issue reported that the FDA has approved a tolerance of 2 ppm residues of Thiodan insecticide on strawberries. The headline for the item, however, indicated that the tolerance was granted for Tedion. The headline was incorrect. *Agricultural Chemicals* regrets the error.

Hooker Advances Wilkenfeld

Jerome Wilkenfeld has been named technical superintendent of the Niagara Falls plant of the Eastern Chemical Division, Hooker Chemical Corp., succeeding Walton B. Scott, who has retired. Mr. Wilkenfeld, assistant technical superintendent since 1955, joined Hooker in 1943.

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Eastman Shifts Four

Robert H. Cannon Jr. has been appointed to the newly-created post of assistant sales manager in charge of field sales by the chemicals division of Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., New York. He had been eastern regional sales manager. In his new post, he is located at Kingsport, Tenn.

At the same time, George J. Taylor, formerly district sales manager in charge of the division's Philadelphia office, was named eastern regional sales manager. W. C. Cook has replaced Mr. Taylor at Philadelphia and R. Clay Dubberly, formerly sales representative in charge, has become district sales manager of the division's Cleveland office.

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Seed Inspectors' Course

The 20th annual Weed and Seed Inspectors' Short Course was held on the St. Paul campus of the University of Minnesota Jan. 9 to 12. The purpose of the course is to provide instruction in weed and seed identification, crop production, weed, insect, and plant disease control, seed certification, federal and state seed laws, public relations, and other related subjects.

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Joins Chipman Chemical

John Van Newenhizen has joined Chipman Chemical Co., Bound Brook, N. J., as a sales representative in New York. His headquarters are at Lyons, N. Y. Mr. Van Newenhizen had been with Baugh and Sons, Newark, N. Y.

GSA Buys DDT

The General Services Administration last month purchased 26 million pounds of DDT, 75 per cent wettable grade, at an average price of 21.81 cents a pound. The insecticide is for use in the anti-malarial program of the World Health Organization.

Contracts were awarded to four suppliers for the entire amount. The succesful bidders were: International division of Allied Chemical Corp., New York, 3.6 million pounds at prices ranging from 21.9 cents a pound to 22.1 cents a pound; Lebanon Chemical Corp., Lebanon, Pa., 4 million pounds priced at 22 and 22.2 cents a pound; Montrose Chemical Corp., Newark, N. J., 8,150,000 pounds for 21.37 and 22.23 cents a pound; and Olin Mathieson Chemical Corp., Baltimore, 10,250,000 pounds for a low price of 20.99 cents a pound and a high of 21.10 cents a pound.

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McFarlin Joins IMC

Richard McFarlin has joined International Minerals & Chemical Corp., Skokie, Ill., as supervisor of inorganic chemical research. He is assigned to the research laboratories in Mulberry, Fla. Mr. McFarlin had been senior research chemist in the Inorganic Division of Monsanto Chemical Co., St. Louis.

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Hooker Advances Moore

John N. Moore has been named manager – distributor sales for the Eastern Chemical Division, Hooker Chemical Corp., Niagara Falls, N. Y. He had been supervisor of distributor sales since 1957. Mr. Moore joined Hooker in 1941.

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Scott Names Five

Scott Paper Co., Chester, Pa., has elected four vice presidents and an assistant vice president to newly-created posts. Paul Brown, Loren V. Forman, Thomas B. McCabe, Jr., and Robert Thieme were made vice presidents. James J. Eberl was named to an assistant vice presidency. All five have been members of Scott's management group.

Mr. Brown now is vice president for retail sales; Mr. Forman is vice president for research, development, and engineering; Mr. Thieme is vice president for manufacturing operations; and Mr. McCabe is vice president for all internal phases of marketing. Mr. Eberl was named assistant vice president for research.

New Dylox Registration

A new registration now provides for lower application rates of Dylox for the control of beet webworm on sugar beets. The new rate is one pound per acre, just one-half the former registration.

Dylox, a 50 per cent wettable powder manufactured by Chemagro Corp., Kansas City, Mo., will not harm beneficial insects at the one pound per acre rate.

AG CHEM TECHNICAL NOTES

Control of Broomrape Studied By California Team

A UNIVERSITY of California agricultural research team has achieved excellent control of broomrape, a serious threat to the state's tomato crop, in tests on a commercial field.

The group reported that soil fumigation with methyl bromide had apparently eradicated the parasitic seed plant from a 10-acre area near Alvarado in Alameda County. Members of the team are Stephen Wilhelm, associate professor of plant pathology; Robert C. Harkens, Alameda County farm advisor; and James E. Sagen, laboratory technician.

In the successful tests, a solution of methyl bromide (available as Weedfume) was applied at a depth of eight inches in the unplanted field through 10 chisels spaced 12 inches apart on the drawbar of a tractor. The solution was injected at rate of 180 to 225 pounds of actual methyl bromide per acre. A smooth, medium-heavy roller drawn behind the chisels rolled the soil immediately after application of the solution.

Tarpaulins of polyethylene sheeting, two millimeters thick, 20 feet wide and up to 1,400 feet long, then were drawn taut over the fumigated soil with the edges buried in six-inch deep furrows. An area slightly greater than half an acre was fumigated and covered in 15 to 20 minutes. After 20 to 24 hours, the tarpaulins were removed from the treated land.

The team said that not a single shoot of broomrape subsequently grew in the fumigated acreage. It expressed the belief that the treatment offers promise for eliminating broomrape at minimum doses of fumigant and at low cost.

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High Analysis Superphosphate

Production of high-analysis superphosphate (54 to 56% P_2O_5) by reaction of phosphate rock with superphosphoric acid was studied in bench scale, pilot plant, and plant scale equipment. Results were best when the acid concentration was about 74% P_2O_5 and the acid was preheated at 180° to 225° F. When the superphosphate was held in a den or storage pile, its temperature reached a maximum of 300° to 350° F. in about 40 minutes. This high temperature promoted fluorine volatilization and rapid conversion of the P_2O_5 to an available form. The superphosphate contained 1% or less of free moisture, and the P_2O_5 was chiefly in the form of anhydrous monocalcium phosphate. About 60% of the fluorine was evolved, compared with about 15% in the production of conventional triple superphosphate. The comparatively anhydrous nature of the product and evolution of fluorine compounds account for the substantially higher P_2O_5 content. Good ammoniating and processing characteristics have been demonstrated in pilot plant scale production of granular fertilizers. Economies should be realized in handling and shipping the more concentrated superphosphate and in the higher grades of fertilizers that can be prepared.

"High Analysis Superphosphate by the Reaction of Phosphate Rock with Superphosphoric Acid" by A. B. Phillips, R. D. Young, F. G. Heil and M. M. Norton. *Journal of Agricultural and Food Chemistry*, Vol. 8, No. 4, pp. 310-315, 1960.

Coastal Builds First U. S. Plant To Use St. Gobain Process

COASTAL Chemical Corp., subsidiary of Mississippi Chemical Corp., Yazoo City, Miss., is the first U. S. plant to make high analysis fertilizers using the St. Gobain process. The fertilizer plant has a capacity of 350 tons/day of 14-14-14, capacity varies with grade manufactured. Construction of the fertilizer plant began in 1957, with construction of a 400/ton/day sulfuric acid plant. This was followed by an ammonia plant and phosphoric acid plant. An important investment saving is in use of a single reactor for making phosphoric acid.

The reactions involved are those of making sulfuric acid from sulphur, ammonia from natural gas and nitrogen, phosphoric acid from phosphate rock by acidulation, and neutralization of phosphoric and sulfuric acid with ammonia. Potassium comes to the finished fertilizer by a physical process. Complexities of the process lie in the side reactions, stemming mainly from the materials with which the phosphorus is associated. Proper control of these conditions is a dominant factor in economy.

Manufacture of phosphoric acid starts with the continuous

conveying of ground phosphate rock, stored in a 350-ton hopper, to the reaction vessel, via a gravimetric belt feeder. A recycle stream of filtered phosphoric acid of medium strength, 20-25% P_2O_5, wets the rock and washes it down into the vessel. At the same time, some 10 tons/hr. of 93-98% sulphuric acid is fed continuously into the vessel, where it mixes with a recycle stream of phosphoric acid-gypsum slurry from the filters. Acid flow is regulated by an automatic control valve while a ratio controller links up the control valve with the gravimetric belt feeder to keep acid and rock feeds in the proper ratio. About 2.6 tons of sulphuric acid are required in the reaction to produce 1 ton of P_2O_5.

The reaction vessel is constructed of steel and lined with acid-proof brick. Efficient agitation is produced by both the method of adding the recycle slurry-acid mixture and by four turbine agitators. The return slurry descends through a funnel-like structure fitted with a vertical propeller. Cooling air enters the vessel through spargers connected to a circular manifold around the top of the vessel. An exhaust fan draws air over the slurry and out through a fume scrubber by means of which hydrofluoric acid is removed. A submerged pump takes out the slurry which is either filtered or recycled with fresh sulphuric acid mixed in it.

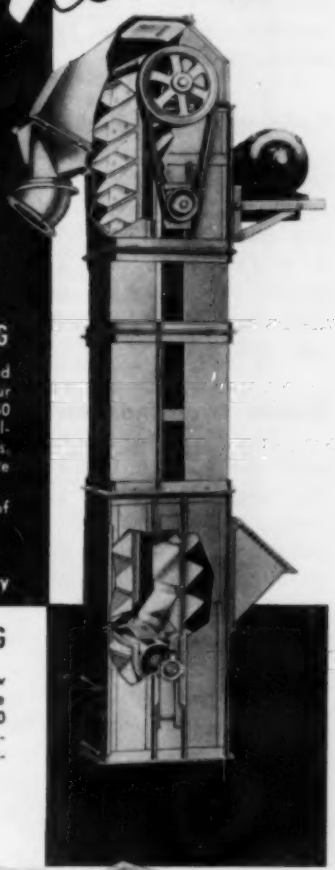
For filtering the slurry, there is a 192 sq. ft. travelling pan vacuum filter and also a horizontal filter, which has a capacity of about 1.1 lb. of P_2O_5/sp. ft./hr. of the traveling pan filter. Product acid goes through a thickener and then to storage. Settled gypsum goes back to the reaction tank.

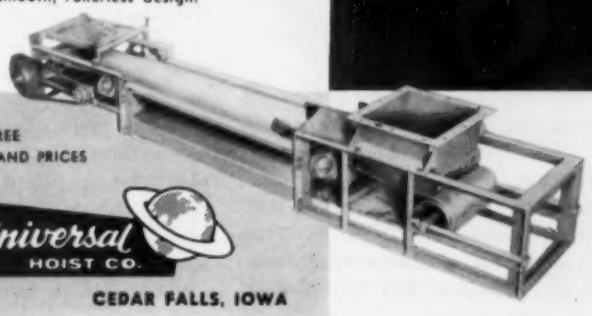
For the manufacture of ammonium phosphate fertilizers, phosphoric acid is fed to the three-stage neutralizing plant, as is also sulphuric acid, liquid anhydrous ammonia being added continuously to permit about 80% of the neutralization to occur. Slurry from the first neutralizing vessel continuously overflows into the second vessel, where the balance of the necessary ammonia is added. The third vessel acts mainly as a slurry surge tank.

Slurry from the third neutralizer is absorbed in a bed of dry recycle fertilizer material moving through a rotating shell granulator, in which the material becomes coated with a smooth, hard granular product. A rotary dryer dries the granules to less than 1% moisture.

The phosphoric acid and granulated fertilizer plants were engineered and constructed by the Fluor Corporation of Los Angeles, California.

"St. Gobain Phosphoric Acid and Phosphate Process by B. F. Greek, F. W. Bless and R. S. Sibley. *Industrial & Engineering Chemistry*. Vol. 52, No. 8, pp. 638-44 (1960).





AG CHEM

Equipment, Supplies, Bulletins

Organic Chlorine Compounds

A 44-page booklet that describes the use of organic chlorine compounds as solvents, extractants, fumigants, intermediates, and special-purpose fluids is being offered by Union Carbide Chemicals Co., New York. The booklet contains comprehensive data on 13 organic chlorine compounds.

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Coddington Bag Shaker

Reductions in bag sizes and resultant savings in bag costs are among the benefits claimed for a bag shaker recently developed by E. D. Coddington Mfg. Co., Milwaukee, Wisc., for use on either their Auger-Matic or Air-Pac valve bag packers.

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Remote Level Indicator

The "Select-O-Level," a remote indicating device for reading the level of corrosive and non-corrosive liquids stored in non-pressure tanks is being offered by Barnard and Leas Manufacturing Co., Inc., Cedar Rapids, Iowa.

Through the use of selector switches, the 12-inch dial gives readings for up to eight tanks on one model and up to 16 tanks on another model. The unit can be located up to 5000 feet from tanks and will read any level up to 33 feet.

•

Lined Tanks For Acid Storage

Two hugh tanks, 10 ft. in diameter, 15 ft. high, have been seamlessly lined with Paraline RD polyvinyl chloride plastic by The Barber-Webb Company, Inc., Los Angeles. Paraline RD is a process of applying a flexible, rubber-like material in liquid form, then baking to produce a tough, seamless coating permanently bonded to the steel.

The coating material is a specially compounded vinyl plastisol made by Metal & Thermit Corp. The finished surface is highly resistant to abrasion and impact as well as to acids, alkalies, salt water and many other corrosives. The tanks are being used to store sulfuric acid.

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NYQ Product List

A 68-page product list containing over 300 items has been issued by the NYQ Chemical Division of S. B. Penick & Co., New York. Sections on antibiotics, chemicals, narcotics, and vitamins contain information on mesh specifications, forms and grades available, and packing. The booklet is available from the company at 100 Church St., New York 8.

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W-C Conveyor Scale Bulletin

A four-page bulletin on the use of conveyor-scale systems for flow-rate control and total thru-put measurement of bulk materials is being offered by Weighing & Control Components, Inc., Hatboro, Pa.

The bulletin deals with the use of W-C conveyor-scale systems in conjunction with flat-bed or trough-type conveyor-line systems, fixed or variable speed, to provide in-motion weight measurement.

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Coddington Bag Packer

E. D. Coddington Mfg. Co., Milwaukee, Wisc., has developed an "Air-Push Hopper" for use as an accessory to the Coddington Air-Pac valve bag packer. The purpose of the new unit is to widen the scope of materials that can be packed by the Air-Pac packer. The Air-Push Hopper eliminates the excessive pressure of several hundred pounds of material in the overhead bin which often makes it difficult to move certain materials which do not fluidize effectively when air pressure is applied, the company points out.

New Westvaco Closure Doubles Impact Resistance of Bags

A FOUR-ply kraft tape closure called "ImpactTape," which doubles the impact resistance of sewn-end multiwall bags, has been developed by West Virginia Pulp and Paper Company, it was announced by Victor S. Luke, manager of the company's Multiwall Bag Division.

Mr. Luke said the new closure tape minimizes bag breakage at the sewing line, which accounts for 70 per cent of all sewn multiwall bag failures. The company has applied for a patent on the new closure, he said.

The ImpacTape closure consists of a piece of kraft tape, the edges of which have been folded under the sewing line with the needle passing through four layers of the tape, instead of two layers as in the conventional closure.

The double-duty sewn tape provides a minimum of twice the impact resistance of standard sewn closures. In addition to the strength imparted by the four sewn tape plies, the inward fold of the tape further cushions the sewing line against sudden shock.

The development of the new tape closure stemmed from studies of bag breakage carried out by the company when it introduced Clupak extensible paper as a new material for multi-wall bags, Mr. Luke said.

D. Scott Sears has been appointed director of research and development at Virginia-Carolina Chemical Corp.

ROUND TABLE

(*From Page* 50)

sparger (under the bed of materials) and replace as needed. He indicates the pipe lasts for about 2000 tons of sulfuric acid.

The length of service of a sparger is a function of grade and solutions used. It should also be recognized that the closer the acid sparger and solution sparger are located, the more frequent will replacements be nceessary.

EDITORIAL

(*From Page* 29)

in 1959, leveled off at a lower rate in 1960. In the past, a drop in farm income would be expected to result in less demand for fertilizer the following year. The heavy consumption of fertilizers in 1960, however, indicates that this no longer is the case.

An additional encouraging prospect facing the fertilizer industry is the improvement in export trade which took place in the last half of 1960 and is expected to continue in 1961. It may possibly tip the balance in favor of exports over imports.★★

WASHINGTON MEETINGS

(*From Page* 44)

pressed pleasure with the work and objectives of the committee when informed of them at the time he visited Oregon State college last fall.

Among new products on which registration has been granted, or is expected shortly is Bayer's 29493 for mosquito control, and Bayer's 30686, an acaricide, which Chemagro hopes to market this spring as Aradex for limited sales for use on cotton, and possibly fruit. Vorlex, to be marketed by Morton Chemical company, appears to control nematodes, soil insects and fungi and some weed seeds. It must be applied to the soil, but it does not need a tarp or water seal, according to James Hughes, Fresno, Calif.

Shell Chemical company plans to bring out Vapona, a phosphate with a lower mammalian toxicity than most in this family, largely for formulators, according to L. C. Glover, San Francisco. It is effective against household pests and can be used for fumigating warehouses. Combined with Thiodan, it is effective in controlling aphids on potatoes, but it is not registered for this purpose.

It is the same chemical that some of the other pesticides become in their process of breaking down, Glover told the industry men. He added that some interesting results had developed with trials of Nemagon in seed treatment of cotton—that apparently it controlled some of the fungous pests attacking the plant.

Another pesticide reported on favorably by several investigators, 18133, which American Cyanamid hopes to market under the trade name of Zinophos, will not be available commercially this year, Frank Kirkpatrick, San Francisco, reported. "We have hopes for 1962, but it depends on the results of tests this year," he added.

Sevin probably will be the material to use against the corn earworm this year, according to the investigators. To protect bees, some night applications probably will be made.

The agricultural industry is becoming aware of the importance of basic research, Dr. A. L. Strand, president of Oregon State college, told the industry men. Dr. Strand, who started his professional career as an entomologist, plans to retire at the end of the school year, so it was his last appearance before the group as a college president.

He compared scientific advances which had been made in the past 90 years with those of the preceding 40 centuries. About 1870

an entomologist mixed some paris green in a bucket of water and splashed it on an apple tree with a whisk broom.

"Apparently there was no one around to check the residue," Dr. Strand observed, "because the apples were not confiscated. It's hard to over-estimate the importance of that mid-19th century period when the Americans walked from superstition and began to test for themselves."

The scientific revolution, as such, is much more recent, starting at the close of World War II. Agriculture as an industry, and pest control in particular are seriously under-budgeted in the field of scientific research. As a consequence, serious imbalances threaten. For one thing we do not seem to be gaining on the problem of resistance, which Dr. Strand classified as "one of the most fundamental and intriguing of any that can be named."

It is this matter of resistance that put great pressure on the chemical companies to develop new insecticides. Much greater cooperation between the federal government and state colleges is needed in planning and carrying out work on the problems that face agriculture.

Several speakers, including Dr. Strand, brought out the fact that there is really no great margin of surplus between what American farmers are producing and what the public is consuming. It was emphasized during the meetings that if population growth proves as great as estimated, serious shortages possibly could develop before the end of the century if protectants and food production capacity are not increased.

Keith Sime, Portland, Miller Products, chairman of the Northwest conference public relations committee, outlined achievements during the past year. One was winning a National Safety council public service award for a TV program on handling pesticides safely. Local and state 4-H club demonstration projects have been set up on that subject.

Industry men who paid the $5 registration fee totaled 165, making it the largest paid attendance in the history of the WACA Northwest conference, Stewart reported. Those who attended for only part time, or for other reasons did not pay the fee undoubtedly brought the audience to a total of more than 200 on the industry side. An equal number of scientists gathered for their various closed meetings.

Dr. James Marshall, entomologist from the Canadian entomological laboratory at Summerland, B. C., was the featured speaker at the conclusion of the week-long meetings.

WASHINGTON REPORT

(*From Page* 66)

new and highly important market for soil insecticides and for herbicides.

One of the new roles expected of agriculturals chemicals is to rid airports of bird populations, and to do it with the blessing of wildlife enthusiasts.

Faced with a growing number of airplane crashes, some accompanied by a substantial loss of human life, the U. S. Fish and Wildlife Service has moved into action. Staff Research Assistant Walter Dykstra reports that birds seek out airports for one reason—they want the food and shelter they find there. U. S. Fish and Wildlife reasons that if the food and shelter can be removed, the birds will fly elsewhere. This will reduce the bird hazard to aircraft *and* save the lives of many birds that otherwise would be killed by the planes.

Most effective means to solve the problem are soil insecticides to kill grubs and other insects eaten by birds, and the use of herbicides to eradicate weeds and weed seeds, sought out by seed-eating birds. Efforts will also be made, where necessary, to remove vegetation which serves as bird shelter around the fringes of airports.

Referring to this development, a Washington-based wildlife writer who frequently attacks the use of pesticides, changed his tune. Wildlife enthusiasts, he said, are not opposed to the use of chemicals when their use is needed to protect human life.

Walter Dykstra, of U. S. Fish and Wildlife, puts the issue more squarely. He says, 'Chemicals are tools that can be used to solve problems that confront men." Saving human life in the airways is one problem chemicals can help to solve. Providing the crops needed by man is an even bigger problem they help to solve.

National Agricultural Chemicals Association, which consistently has sought bases upon which to increase friendly contacts with the wildlife groups, sees this new development as a chance for real cooperation in solving a serious, mutual problem.

Optimistic Outlook

Good news for fertilizer companies! The general mood among Industry and Government people is optimistic for a better year in 1960-61 than they had in 1958-59. Sales so far have been going along at a good clip. The only cloud in the sky is the possible effect of the general economy upon farmer purchases if business fails to turn up in the spring.

Fertilizer sales record over the past few years has been good. During the year ending June 30, 1959, fertilizer consumption reached 25.3 million tons, up 12 percent over 1957-58. While final figures aren't yet in, it's expected consumption in 1959-1960 will show a further increase of 5 to 7 percent.

Industry leaders here figure that two strong forces are working on the side of a further increase in fertilizer consumption this year. One is the National Plant Food Institute's cooperative program to promote soil testing and increased use of fertilizer on a community-

wide basis. The other is Agriculture Secretary Freeman's strong desire to increase farmers' income.

As NPFI programs have proved in the past, one of the quickest ways to increase farmers' real income is through the adequate use of fertilizers.★★

FERTILIZER VIEWS

(*From Page* 53)

same results were obtained. These crops utilized the residual phosphorus, which is "fixed" phosphorus," years after treatment was discontinued.

The conclusion stated by Dr. Rogers is pertinent at this point:

"When the full story is told on residual phosphorus, this fixing capacity of soil may be seen as an asset rather than a detriment to long-term needs in soil fertility. It would appear that we have greatly overemphasized the seriousness of phosphorus fixation, and might well direct our efforts at more promising schemes for improving fertilizers."

I agree. The need for complete, water-soluble phosphorus does not appear necessary, except on limited areas of the Northwest where calcareous soils predominate. Fixation of phosphorus should be welcomed as one of Nature's methods for preserving to our agriculture one of the country's most precious resources.

It is generally accepted by most American agronomists that if 50 to 60 per cent of the phosphate of a mixed or straight fertilizer is of the water-soluble kind, that amount is adequate for supplying the crop's needs.★★

WISCONSIN REPORT

(*From Page* 49)

that pesticide treatments have no economic and esthetic value. But it noted that unrestricted use of pesticides had caused significant wildlife losses in some areas.

The committee cited a need for official designation of state agencies to be held responsible for determining if wildlife is being affected by pesticide practices. Education also was urged for those who handle quantities of pesticides. The report recommended that annual conferences be held so that pesticide dealers, commercial operators, and others involved in the pesticide "problem" might be trained in the proper use of these chemicals and informed about the hazards. The committee added that it is imperative that biological means be employed wherever practical, instead of chemicals, and that this approach be developed as rapidly as possible "to replace or reduce the amount of pesticide chemicals now in use."

CALIFORNIA REPORT

(*From Page* 49)

effect on soil microbiology or on soil structure. At the present time, the report continued, there is no information to show any hazard to health from agricultural chemicals in soil, but research on this subject should be expanded with special attention to long-term and cumulatve effects.

The question of injury to bee colonies that are maintained in areas subject to pesticide treatment also was considered by the committee. They noted that there is need for investigation and research to discover more ways to provide more protection for bees. At this time, however, the committee recommended careful admnistration of present regulations pertaining to use of insecticides as the most hopeful approach to the problem of the bee industry.

The hazard to fish and wildlife because of direct exposure to pesticides is believed to be relatively small, the committee said. It added, however, that the indirect effects can be profound although they are more difficult to appraise exactly.

Referring to the practice of organic farming, the committee said that it is occasionally suggested that the use of agricultural

chemicals be abandoned entirely and that farmers follow a practice of organic farming. This type of farming, the committee pointed out, can be successful in limited areas with a few crops, but, the report added, it cannot furnish the nation with its main supply of food. Presently, organic farmers benefit from the suppression of pests in surrounding areas through use of agricultural chemicals, the committee said, and a great increase in untreated acreages would likely reduce the present relative success of organic farming. The committee said also that, at the present time, the use of natural predators for suppressing injurious insects and weeds, and other methods of biological control, "offer only a very limited practical hope."

In conclusion, the committee said that no evidence is presently available that there is any danger of anyone being poisoned by pesticide residues in food. The report recommended that the public be provided continuous information concerning the regulations and safeguards that are in effect to protect the consumer, because a fully informed public can evaluate the facts and will not be panicked by "scare" stories.★★

PEST ROUNDUP

(*From Page* 62)

vious year. Delaware and New Jersey showed decreases, with counts of 262 and 183, compared with 394 and 270 in 1959, respectively.

The survey in Arkansas showed a slight increase in the average number of borers found over 1959. The State average in 1960 was 65 and in 1959, 54.

The European corn borer was recorded in only 6 new counties in 1960, 4 in Georgia and one each in North Carolina and Virginia. Negative surveys were conducted in New Mexico, Texas, and Wyoming.

Based on all comparable districts or counties, the average number of European corn borers per 100 corn stalks examined increased from 86 in 1959 to 129 in 1960. The increase in the Central States was from 67 to 131 while in the Eastern States there was a slight decrease from the 148 in 1959 to 136 in 1960.

Hibernating Boll Weevils

Woods trash samples were collected by cooperating agencies from four areas in North and South Carolina to determine the number of boll weevils entering hibernation. Average counts were higher than found in the fall of 1959.

In the south central section of South Carolina, comprised of Orangeburg, Bamberg, and Dorchester Counties, the average number of live boll weevils found per acre of woods trash was 3,308, compared with 1,318 in 1959. The coastal plains area of South and North Carolina, made up of Florence, Darlington, and Marlboro Counties, South Carolina, and Scotland County, North Carolina, averaged 13,148 live weevils per acre. This area had an average of 5,082 last fall.

The Piedmont section of the Carolinas consists of Anderson, Greenville, and Spartanburg Counties, South Carolina, and Macklenburg, Cleveland, and Union Counties, North Carolina. Average number of live boll weevils per acre of woods trash found in this section was 8,954, compared with 4,383 during the 1959 survey. Edgecombe, Franklin, Nash, and Wilson Counties constituted the north central section of North Carolina. In this section, the hibernation survey showed an average of 2,582 live boll weevils per acre of trash. In 1959 only 834 per acre were found.

The average number of live boll weevils per acre of woods trash found in Louisiana, Mississippi, and Tennessee were reported in detail in this magazine last month. However, to summarize the reporting states, the averages are being repeated. In Louisiana the 1960 average was 11,487, compared with 8,097 found in the 1959 fall hibernation survey; in Mississippi, 14,502 in 1960, and 5,127 in 1959; and in Tennessee, 2,622 in 1960, and 1,882 in 1959.

Although weather will be a definite factor in the number of boll weevils entering the cotton fields next spring, the fall populations are such that the potential bears close observation. Prior to spring emergence, another woods trash survey will be conducted to determine the number of weevils surviving the winter.

Grasshopper Acreage Down

The annual fall adult grasshopper survey shows fewer acres of rangeland with a moderate or above population, 8 or more grasshoppers per square yard, than were found in the fall of 1959. The total acreage of range in the above category is 4,467,720, compared with 5,667,010 in 1959. Montana has the largest infested acreage with 1,327,000, followed by California with 882,800. Colorado, with 618,000 acres, Washington, with 454,700 acres, and Texas, with 353,700, are the next highest states.

The adult grasshopper infestations on croplands found in the fall of 1960 were slightly higher than those found in the fall of 1959. The increase is largely in North and South Dakota, Minnesota, and Wisconsin.★★

RESIDUES

(*From Page* 47)

were not present in significant amounts.

Residues in fat from feeding Heptachlor epoxide were shown to be about ten times as great as those from the same level of Heptachlor.

All of the chlorinated hydrocarbon insecticides and Co-Ral and Malathion were excreted in the milk of dairy cows following spray treatments. Rotenone was not excreted in the milk and Co-Ral was present in very small amounts. Dieldrin caused the greatest contamination, followed in order by

DDT, TDE, Dilan, Toxaphene, Strobane, Methoxychlor, Perthane, Malathion, and Co-Ral. When Sevin, dicapthon, and Bayer 22408 were fed to dairy cows as a contaminant of their feed at dosages in excess of those likely to occur on forage crops, residues of these insecticides were not detected in the milk.

In a sampling of milk from commercial dairies in which barns and cows were sprayed with DDT or TDE, all the test herds excreted detectable amounts of insecticide in their milk throughout the fly season. The average contamination was 0.21 ppm for herds treated with DDT and 0.25 ppm for herds treated with TDE.

A study made at Kerrville to determine the source of milk contamination when dairy barns were sprayed with 2.5 per cent of DDT indicated that (a) the insecticide actually was secreted in the milk and did not get into it from mishandling of the milk or equipment, (b) no contamination resulted from inhalation of the insecticide by the cows, and (c) the insecticides excreted in the milk came from residues left on the feed troughs. Contamination did not occur when feed troughs were completely covered during the spraying or were washed afterwards.★★

WEED MEETING

(*From Page 33*)

the carrier, Dr. Sweet said, may play an important role, but little is known regarding such factors as the several types of carriers, particle size, percentage of the carrier, and the best method of formulation.

Dr. Sweet said that the influence of environment and soil on granular formulations, as compared with conventional formulations, is sufficiently well understood. Even distribution of the herbicide at the desired rate, he said, is as necessary with granules as with liquids. He added, however, that presently available equipment does not lend itself to easy, accurate application. However, he concluded, equipment manufacturers are aware of the needs, and, presumably, in the near future will have machines available to do the job well.

Recent developments in the use of Vegadex (2-chloroallyl diethyldithiocarbamate) (CDEC) were outlined by R. E. Althaus and L. S. Gleason, Monsanto Chemical Co., St. Louis. They said that the performance of Vegadex is enhanced under moist soil conditions. Since many vegetable growers irrigate and, also, because many of the vegetable production centers are in areas of adequate rainfall, they pointed out, this has not been a serious deterrent to the use of Vegadex, but it has contributed to several failures. The moisture requirement for granules and for sprays is equally important, they added.

Mr. Althaus and Mr. Gleason said that it is becoming increasingly obvious that with good broad-spectrum, pre-emergence selectivity, long residual activity has to be sacrificed. This is also the case for vegetable fields that are cropped more than once per season, they added. With this in mind, they recommended the use of Vegadex on a repeat application basis for season-long weed control. In previous years, they said, such use was hampered by various degrees of toxicity to foliage. Granular formulations, however, may tend to improve the performance of post-transplant or lay-by treatments and reduce crop residue problems. Continued field experience by the grower, they said, is opening many avenues of successful uses for Vegadex for control of weeds in vegetable crops. Depending on adaptability and suitability, the applications of Vegadex will include sprays and granules, both pre- and post-emergent to the crop.

Preliminary studies on crop tolerance and weed control with a new thiolcarbamate herbicide, (R-

butyl di-*n*-propylthiolcarbamate), were discussed by Reed A. Gray, Ralston Curtis, and Joseph Antognini, Stauffer Chemical Co., Mountain View, Calif. They reported that greenhouse tests with the material were carried out with R-1856-6E, an emulsifiable concentrate formulation containing 6 pounds of the compound per gallon. In these tests, a number of horticultural crops and a few agronomic crops were tested at various rates and found tolerant to rather high levels of this compound. On the other hand, it was reported, pea, soybean, small lima bean, milo, wheat, and several lawn grasses were injured by R-1856 at a rate of 5-10 pounds per acre. A limited number of field tests have substantiated the greenhouse findings, they said.

Although growers frequently use several insecticides or fungicides in combination in order to control the range of pests that may attack a given vegetable, the use of herbicides in combination has been negligible, except in a few isolated cases such as CIPC plus CDAA for weed control in onions on muck soils. With this in mind, Joseph Cialone and R. D. Sweet of Cornell University reported on studies of combinations of CDAA and other compounds for weeding vegetables. In their tests, logarithmic, tank-mixed combination applications of CDEC and CDAA, CDEC and CIPC, CDAA and CIPC, CDEC and Solan, and Dacthal and Solan indicated that CDEC and CDAA show promise for good weed control without damage to a wide range of seeded vegetable crops. CIPC in combination with CDEC proved relatively toxic, they reported, and Solan and Dacthal gave excellent results with carrots. In an extensive follow-up test of CDEC and CDAA combinations, it was found that beets, spinach, tomatoes, carrots, and, perhaps, crucifers offer opportunity for safe usage. Lettuce, however, proved too susceptible to CDAA.

Considerable more work needs to be done, they said, in the area of herbicide combinations for vegetables under a wide range of soils, environment, and weed specie populations. However, they concluded, it appears that CDEC and CDAA offer a promising start.★★

NEMATODE CONTROL

(From Page 41)

stance, bacteria may be affected to the extent that the nitrification processes in the soil are inhibited. There may also be direct phytoxicity to crops. When properly used, however, the chemicals have a short life in soil and most harmful effects disappear within a few days. While far from perfect, therefore, they represent the only means of quickly ridding large quantities of soil of harmful nematode populations. There simply is no other recommendation in most cases.

In specific instances, of course, many control procedures other than chemical means have been developed. Certain nematodes, cyst nematodes of the genus *Heterodera* for example, have narrow host ranges and crop rotations are used for successful control. Flooding, drying, or combinations of the two are used in some areas, especially for the control of root-knot nematodes. In addition, plant quarantines are employed to prevent the spread of certain nematodes, and also to keep planting stock parasite-free.

Plant breeders and nematologists have made progress toward the development of resistant varieties of only a few plants to a few nematodes. In most cases, furthermore, varieties resistant to a wide range of nematode species have not been developed. Thus, this type of control has been useful only in cases where the plant is attacked by one or a few species within a local area. Non-host trap crops to attract the nematode but prevent destruction have been employed with little success.

Most types of control, therefore, are preventive treatments, since by the time visible symptoms occur the crop may already be damaged appreciably. With this in mind, work is needed to improve determinations of plant parasitic nematode population potentials within given fields. In some cases, this might be accomplished by direct examination, but in others a technique of growing indicator-plants is indicated. Recognition of the frequent nematode damage to perennial plants has emphasized the need for measures to rid infected plants and the surrounding soil of harmful nematodes. Some of the newer soil nematocides may be used in certain instances, but exact procedures for application are yet to be determined. The possibilities of systemic nematocides are being explored in this regard. Control measures other than chemical also are receiving the attention of nematologists. In a test program being conducted in southern Florida, pangolagrass is being used in a pasture-vegetable rotation and apparently reduces the incidence of root-knot nematodes on vegetable plants. Biological control through the use of natural enemies appears possible in limited area crop production and, with future development, possible field control is indicated, especially if biological control is used to prevent re-establishment of populations following more direct control methods.

It seems reasonable, therefore, to state that future research into the development of control measures for the plant nematode should include biological avenues of control in addition to chemical control. Growers who will most successfuly combat nematodes in the future will do so by a combination of several of the procedures mentioned above.★★

COTTON CONFERENCE

(From Page 37)

Government, implemented by industry, and practiced by agriculture, he pointed out, is founded

so firmly on logic and facts, and so tempered with extra precautions, that there should be no need even to defend it. It might be more realistic, he added, if critics of present-day pesticide use were challenged to accept full responsibility for our food supply if pesticide usage were to be unrealistically curtailed.

Research shows, he said, that pesticides can be used with safety. And certainly, he added, it makes good sense to use them safely. Otherwise, he warned, prohibitively restrictive legislation may be required to police the few individuals who are not careful in using these materials.

The label still is the best available source of information on how to use a pest control product on a food crop, Dr. Haller stressed. Our Pesticides Regulation Branch, he said, now is reviewing the uses of the registered labels and if new evidence is developed to challenge the validity of a registration, appropriate action will be taken immediately to correct the label.

In closing, Dr. Haller listed two points that he said are so important that they cannot be overemphasized. First, he said, the overwhelming fact that has clearly emerged from the many studies, hearings, and discussions of the past few years is that our foods are safer and more wholesome than ever before, and chemicals used on farms help make them so.

Second, he continued, it is vital to keep in mind that the label tells the story. Before using a pesticide, he advised, read the label carefully and follow directions. Thus, he closed, it becomes the responsibility of all concerned to work diligently to keep our food supply safe.

Also among the speakers at the meeting was Dr. A. L. Smith, plant physiologist at the Alabama Experiment Station in Auburn, who outlined methods to control wilt and nematodes – factors that now cost cotton farmers almost $50 million a year. Dr. Smith recommended the use of wilt-resistant plant varieties on soils known to be infested and the use of soil fumigants on severely infested soils where resistant varieties are not available. He also recommended the practice of rotation of cotton with corn, sorghum, small grains, and other crops.

Dr. Walter J. Mistric, North Carolina Experiment Station, Raleigh, reported that North Carolina has adopted a new cotton insect control program as the general statewide recommendation for 1961. He said that the new program could easily double the statewide cotton crop yield and would reduce the control burden on conscientious farmers by 50 per cent. The program is designed to standardize and simplify control methods.

Boll weevil migration will remain the limiting entomological factor in cotton production until we achieve much greater grower participation in early season control, Dr. Mistric stated. Most of our future research effort, he added, will be directed towards obtaining a higher degree of control of overwintered weevils.★★

CROP RESPONSE

(From Page 31)

response to the phosphorus in dicalcium phosphate and the geometric surface area of the granules. Size of component crystals within the granules was of much less importance. Terman, Bouldin, and Webb (7) found that effectiveness of a series of water-insoluble phosphates prepared by leaching ammoniated superphosphates and nitric phosphates also increased with increase in surface area of the granules. With these phosphates quite finely divided, however, the granules tended to dissolve and the plants apparently obtained much of their phosphorus from the fertilizer-soil reaction products.

Granule size and water solubility relationships of phosphorus

fertilizers in relation to crop response on acid soils (below pH 7.0) may be summarized as follows:

1. With phosphates of low water solubility, such as dicalcium phosphate, rate of solution of phosphorus is the dominant factor in plant availability, which is closely related to the surface area of the granules. Thus, granules of phosphates of low water solubility should be relatively fine (about 35-mesh). Effectiveness of such fertilizers, regardless of size, may be decreased by banding, as compared with broadcast application.
2. With water-soluble phosphates, such as unammoniated superphosphate and ammonium phosphates, dissolution and diffusion of phosphorus from the fertilizer granule into the soil, and reaction with the soil to form less soluble phosphates are the dominant factors. Granules of these phosphates should be relatively large (about 6-20 mesh) and the optimum size will vary with the capacity of the soil to fix phosphorus, and with other factors. Banding of finely divided soluble phosphates near the seed may be a satisfactory substitute for granulation under many soil conditions. Results indicate that with about 50% of the phosphorus in water-soluble forms, granule size may not be important.
3. A source of confusion in the interpretation of results from granule size-water solubility and other types of experiments has been the difference frequently found between early growth response in greenhouse pots or in the field, and final yields in the field. Marked differences for granule size and water solubility effects are usually found early in the growth period on phosphorus-responsive soils. Whether these early growth differences follow through to final yields of grain or forage depends on several factors. These include level of available phosphorus in the soil, adequate supplies of other nutrients, moisture supply, length of season, kind of crop, and probably other factors as well. Final yield differences are found more frequently with potatoes and other vegetable crops than with corn, cotton, or small grains.

Crop response on alkaline soils (above pH 7.0) is frequently as good or better to broadcast application of finely divided phosphates as it is to application in bands. Similarly, there is less advantage in crop response to phosphorous for granulating fertilizers for use on calcareous soils than for use on acid soils.

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Jr. Crop response to ammoniated superphosphates and dicalcium phosphate, as affected by granule size, water solubility, and time of reaction with soil. *J. Agric. and Food Chem.* 8: 13-18. 1960.

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EUROPEAN TECHNOLOGY

(*From Page* 40)

erally is better in Europe than in the United States since most countries use alkaline rather than neutral ammonium citrate solution as the reagent for evaluating availability. Dicalcium phosphate is soluble in the alkaline reagent, but more basic calcium phosphates are only slightly soluble. For this reason, ammoniation of nitric phosphates must be carefully controlled to avoid formation of the more basic phosphates. Ammoniation of superphosphates to the extent commonly practiced in the United States would result in very serious reversion of the phosphorus to forms insoluble in alkaline ammonium citrate owing to extensive formation of basic calcium phosphates such as hydroxyapatite. Hence, heavy ammoniation of superphosphate is not a common practice.

Nitrogen Fertilizers

THE principal nitrogen materials produced for direct application are ammonium nitrate–limestone (20.5% N), ammonium sulfate, ammonium sulfate nitrate (26% N), calcium nitrate, and calcium cyanamide. Although there is a fairly large and increasing production of urea, this material is used principally for nonfertilizer purposes or is exported for fertilizer use in other countries. Only a small amount of the urea is used in Europe for fertilizer. Some manufacturers stated that the high nitrogen concentration of urea made it economically attractive for export to distant countries, and that lower grade nitrogen materials were more economical for domestic use. Also, some authorities felt that more research was needed on the characteristics of urea as a fertilizer for European soils and crops.

Ammonium nitrate–limestone appears to be the most popular straight nitrogen material. It usually is prepared by granulating concentrated ammonium nitrate solution with ground limestone, chalk, or marl in a pugmill. The principal purpose of the limestone addition is to render the product nonexplodable. Many producers feel that a smaller proportion of limestone or other inert material would be sufficient to ensure safety. A proposal to decrease the diluent content to such proportion as to yield a 27% nitrogen product (rather than 20.5% N) was reported to be under consideration.

Direct application of anhydrous ammonia or other liquid fertilizers has not gained any appreciable acceptance in Europe. Some producers felt that the small size of the farms and the character of the soil were not well suited to the direct use of ammonia. The expense of new application equipment, the small farm size, and the high cost of entirely soluble materials were mentioned as drawbacks of liquid mixed fertilizers.

Most of the companies carried on an active research program in the field of fertilizer manufacturing technology. Several of them also had agronomic research facilities in which prospective new products were tested.

Most fertilizer manufacturers were engaged also in the manufacture of other chemical products. It appeared that a large proportion of the chemical-grade phosphates were made from wet-process acid. Many manufacturers produced wet-process acid and used part of it for chemical-grade phosphates and part for fertilizers. Impurities removed from the acid in the preparation of chemical-grade phosphates contained appreciable quantities of citrate-soluble phosphates, and these impurities often were incorporated in mixed fertilizers.

The purpose of this brief report has been to make a few observations of general interest to the fertilizer industry about European technology. It is not possible or appropriate to deal in this report with detailed information in the many phases of fertilizer manufacture. It is suggested that technologists of our country would find it well worthwhile to visit European companies to exchange information on problems of mutual interest.

The author was impressed by the cordiality, hospitality, and friendly attitude with which he was received by fertilizer manufacturers in Europe. The technical people seemed genuinely pleased to discuss their operations and research and to show their laboratories and plants.★★

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LOUIS J. FINN, manager of the Bemis Bro. Bag Co. plant and paper mill at Peoria, Ill., has retired from the company. He had been with Bemis since 1914. Mr. Finn has been at the Peoria plant since 1925.

AC

HARRY K. STUEBER has been named export sales manager, agricultural chemicals, for the Davison Chemical Division, W. R. Grace & Co., Baltimore. He has been with Davison since 1954.

AC

INTERNATIONAL ORE & FERTILIZER CORP. has taken over the entire 29th floor at 500 Fifth Avenue, New York. This increases the space formerly occupied by the company in the same building.

AC

RICHARD E. MCCLAINE has been named central district manager of the Baughman Manufacturing Co., Jerseyville, Ill. His territory includes all states east of the Mississippi River and north of Mississippi, Alabama, Georgia and North Carolina.

C. K. HARMISON, director of the Feed, Seed, Fertilizer, and Chemical division of Farmers Union Central Exchange, South St. Paul, Minn., died Dec. 21. He was 55.

AC

EDWARD W. MAY has been appointed eastern district manager for Naugatuck Chemicals, division of Dominion Rubber Co., Ltd. His territory includes eastern Ontario, Quebec, and the Atlantic provinces.

AC

ALBERT M. JUERGENS, JR. has joined the Wallerstein Co., division of Baxter Laboratories, Staten Island, N. Y., as assistant to the company's president. He had been with American Cyanamid Co.

AC

DR. ROBERT F. CRAWFORD has been appointed agricultural research scientist for U. S. Borax Research Corp., Anaheim, Calif.

AG CHEM

INDEX TO ADVERTISERS

AG CHEM

TALE ENDS

AT this time last year, when it was announced that a number of states planned to form committees to look into the use of pesticides, we expressed the fear that this might lead to each state's eventually preparing its own rules and regulations governing the use and sale of pesticides so that instead of one nationwide set of regulations, the industry would be faced with 50 different sets of laws. Now that the committees are beginning to make their reports, (see page 49) our concern seems justified. A sample of the inconsistencies to be expected is contained in a comparison of reports presented by committees in Wisconsin and California. In urging stronger regulation of pesticide use, the Wisconsin committee said that it "was imperative that biological means be employed wherever practical . . . to replace or reduce the amount of pesticide chemicals now in use." On the other hand, the California committee, reported that the use of natural predators for suppressing injurious insects and weeds, and other methods of biological control, "offer only a very limited practical hope."

AC

Who pays the bill for the field evaluation of new pesticides? In particular, who pays the bill for the field testing of specialty products with only a limited field of application? In the past, the land grant colleges and the U. S. Department of Agriculture often shared the rather substantial cost of this type of work, making it possible for basic producers of the new pesticides to check out new products for the market, without assuming testing costs which might well be prohibitive. If, in the future, the pesticide industry must carry the load alone on field testing, we have the feeling that there are many promising products which will never get to market.

AC

An effective argument in favor of the use of chemical fertilizers is advanced by Armour Agricultural Chemical Company in its consumer advertising this season. A Vertagreen advertisement, for example, shows a satisfied customer who compared Armour's fertilizer with his own home blended mixture in adjacent plots. The results were "amazing" according to the customer who harvested 37½ per cent more potatoes from the plot fertilized with Vertagreen than he did from the plot fertilized with the "home mix." The ad points out that "it isn't how little a fertilizer costs, but how much it does that counts."

AC

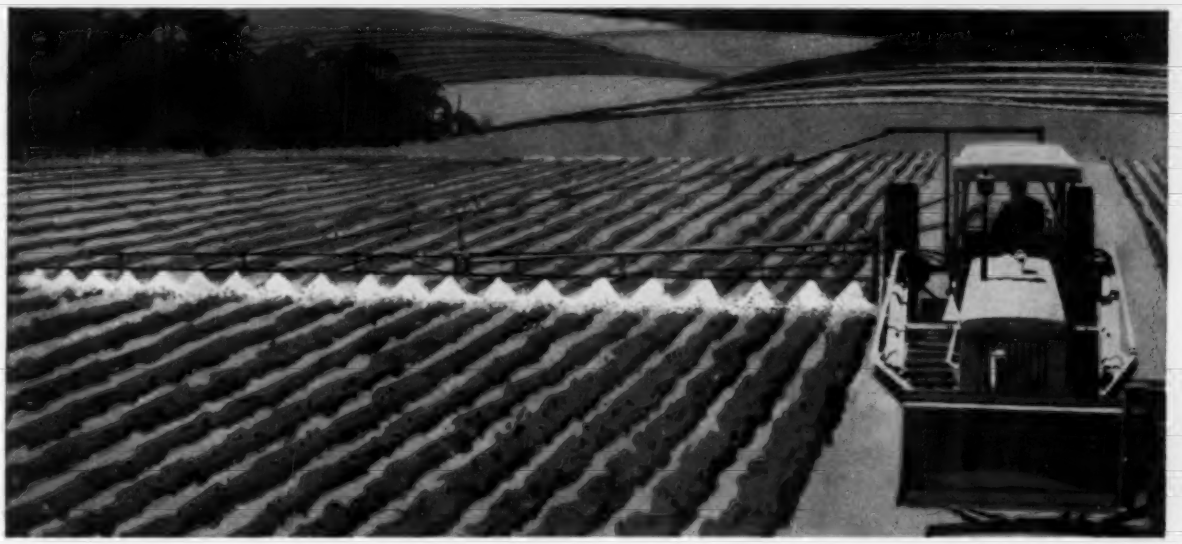
The recent embargo placed by the U. S. on shipments of goods to Cuba put an end to that country's rapidly increasing purchases of pesticides from U. S. producers. Figures showing dollar exports of pesticides from the U. S. to Cuba during the past three years are quite revealing. In 1958, Cuba took $2,228,000 worth of insecticides from the U. S. and in 1959 this figure rose to $2,242,000. During the first six months of 1960, $1,786,000 worth of insecticides went to Cuba and exports in the third quarter, just prior to the embargo, brought the nine-month total for 1960 to $3,964,000 worth of insecticides to Cuba. In those last three months Cuba purchased as much pesticides as they had been purchasing per year. The bulk of pesticides shipped to Cuba during this period was comprised of DDT and other chlorinated hydrocarbons and some phosphorus insecticides. It is too early, of course, to tell what effect this will have on the crops in Cuba but if Premier Castro continues to mobilize his militia at harvest season, it may not make any difference at all.

AC

Reports coming in from the midwest and the south indicate that 1961 will be an excellent year for pesticide sales. European corn borer counts are well up in the corn-growing areas of Iowa, Wisconsin, Minnesota, and North and South Dakota — while counts of overwintering boll weevils in the cotton-growing states are at record highs.

AC

It is too bad that the USDA's press people didn't inform the pesticide industry about the U. S. exhibit at the International Agriculture Exhibition in Cairo, March 21, until it was too late for all but a few to be represented.



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President and Chairman of the Board,
Hercules Powder Company

(from an address before the Societe de Chimie Industrielle, Barcelona, Spain, October 26, 1960)

AGRICULTURAL CHEMICALS DIVISION · *HERCULES POWDER COMPANY*
INCORPORATED
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